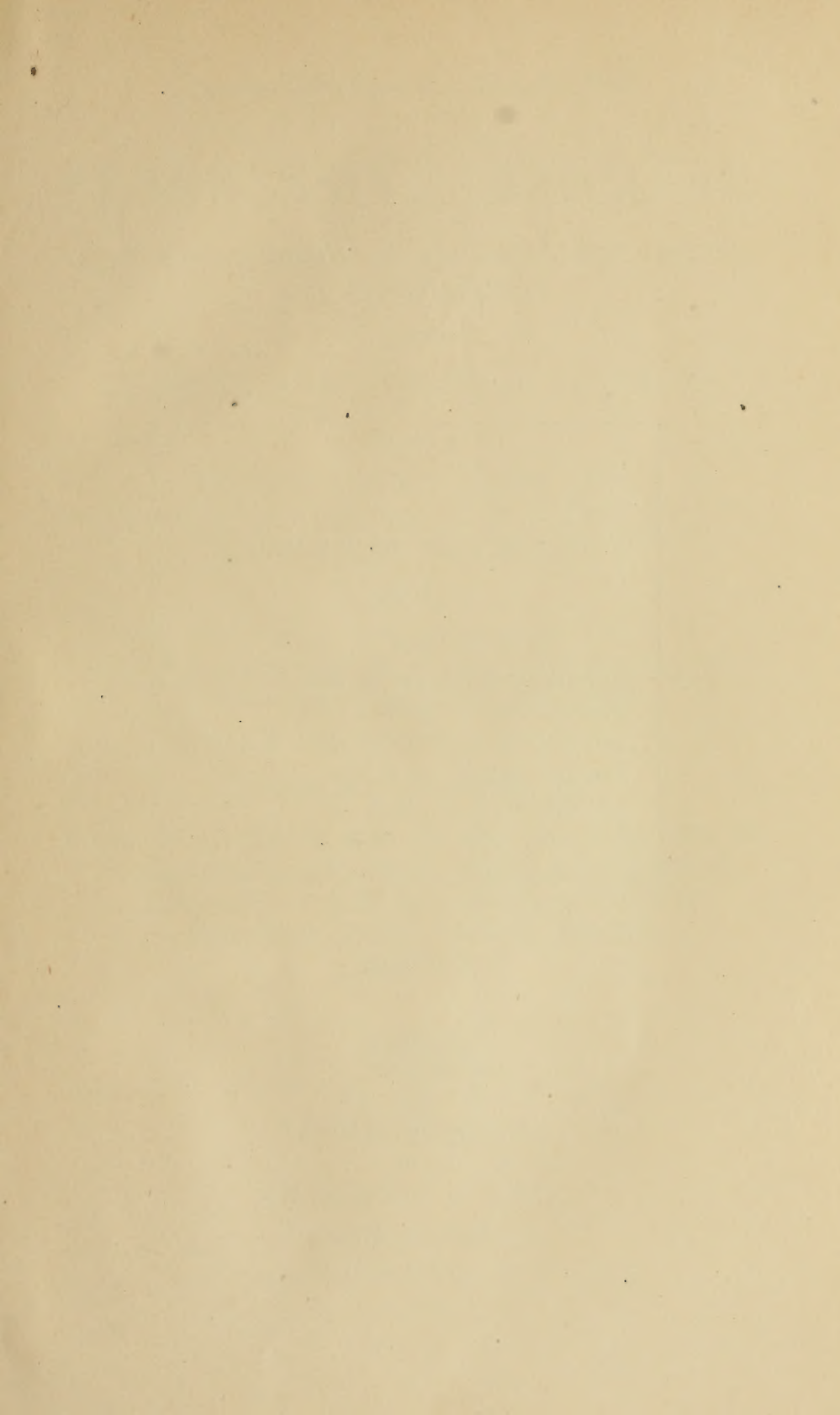




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PROGRESSIVE MEDICINE.

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES,
AND IMPROVEMENTS

IN THE

MEDICAL AND SURGICAL SCIENCES.

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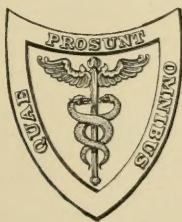
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VOLUME IV. DECEMBER, 1908.

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER AND PANCREAS—DISEASES OF THE KIDNEYS—SURGERY OF THE EXTREMITIES, TUMORS, SURGERY OF JOINTS, SHOCK, ANESTHESIA, AND INFECTIONS
—GENITO-URINARY DISEASES—PRACTICAL THERAPEUTIC
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PROGRESSIVE MEDICINE.

DECEMBER, 1908.

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER AND PANCREAS.

By DAVID L. EDSALL, M.D.

DISEASES OF THE ESOPHAGUS.

A New Swallowing Sign. In relation to the esophagus little has been done that seems very significant. Some interest attaches to an article by Rewidzoff,¹ who describes a new sign that he considers to be of undoubted value in the diagnosis of organic *strictures of the esophagus*. As is well known, when a patient swallows liquid, two sets of sounds may be heard in the epigastrium, the second of which is the most important. It occurs from six to eight seconds after the beginning of swallowing. In either spasmodic or organic strictures the occurrence of this sound is usually considerably delayed. Rewidzoff's sign consists in the fact that after this sound has been heard in patients with organic stricture, if they be instructed to repeat the swallowing movements, without, however, taking any additional liquid, the sounds will again be heard. This procedure may be repeated three or four times in succession, each time new sounds being heard.

He describes the nature of this sign as follows: There is always more or less dilatation of the esophagus above a chronic stricture. A single swallowing movement is not sufficient to force all the contents of this dilated portion past the stricture; since a considerable quantity of the swallowed material remains in this position, each additional swallowing movement forces more of the material past the narrow portion of the channel. He designates the sounds produced by these subsequent acts of swallowing as residual swallowing sounds. The more marked the stricture, the more numerous will be the residual sounds, unless,

¹ Berl. klin. Woch., 1908, Nr. 15, p. 749.

of course, the stricture be one that entirely obliterates the lumen. The author considers the sign to be of especial value in the differentiation of organic from spasmodic strictures. While it is of some interest it can scarcely prove to be very important. The swallowing sounds have a limited value in determining the existence of a stricture, but this modification can hardly be expected to be very important in distinguishing as to the character of the stricture.

Rupture of the Esophagus. The first case of spontaneous rupture of the esophagus was that reported by Boerhaave. Cohn¹ reports a similar case and collects thirty-seven cases in addition to his own and Boerhaave's. Combining the statistics derived from these cases, Cohn designates the features of spontaneous rupture of the esophagus as follows: It occurs almost exclusively in men, usually drinkers, in middle life. The rupture has almost invariably succeeded upon the act of vomiting. The most prominent symptoms have been bloody vomit, agonizing pain in the epigastrium, occasionally a sensation expressed by the patient as though something had ruptured within him. Later there is collapse, dyspnea, and cyanosis, followed shortly by emphysema of the subcutaneous tissues. Death usually occurs a few hours, occasionally a few days, after the rupture. With the exception of Boerhaave's case, the finding at autopsy has been a longitudinal tear in the lower third of the esophagus. In Boerhaave's, the rupture was a transverse one, about 3 cm. above the cardia.

Cohn's case is somewhat unique, in view of the fact that the rupture occurred immediately after the withdrawal of a stomach tube. Cohn does not believe that the passage of the tube could be looked upon as the cause of the rupture, as he does not think that it is possible to rupture a normal esophagus by the passage of a stomach tube. Moreover, the rupture was of the same nature and in the same position as in all the previous cases reported in which no stomach tube had been passed. Had it been caused by the tube it would be rational to look for a round hole, rather than a longitudinal tear.

There has been much discussion as to the actual cause of the rupture in these cases. Gramatzki believes that injury to the esophagus by a foreign body has been a prominent predisposing cause in most of the cases with which he is familiar. Ziemsens and Zenker, later, propounded the view that an esophagomalacia always precedes the rupture. They proved experimentally that it is impossible to create sufficient pressure within the stomach and esophagus to rupture an esophagus that has not been previously diseased or injured. They think that in all these cases regurgitated gastric juice has acted upon the esophagus and digested a part of the wall. This digestion of a part of the esophagea, wall is, in addition, favored by circulatory disturbances, usually ischemial

¹ Mitth. a. d. Grenzgeb. d. Med. u. Chir., 1908, xviii, 295.

of the part involved. Mackenzie also investigated the subject experimentally, and came to the opposite conclusion. He concluded that the combined force of the abdominal muscles, the diaphragm, and the muscles of the stomach can produce, in the act of vomiting, an increase in the pressure sufficient to cause a rupture of the esophagus. He thinks, however, that the vomiting can lead to rupture only when the gastric contents cannot be forced out of the esophagus with their usual rapidity; in other words, only when there is a partial obstruction in the esophagus above the point of rupture, or when the amount of gastric contents is unusually large. He believes, moreover, that adhesions between the esophagus and neighboring organs that interfere with the movability of the former are predisposing factors in the rupture.

Brosch, who also conducted a large series of experiments, concludes that there is great individual difference in the resisting powers of the esophagus, and that the actual cause of the rupture is to be sought for in changes in the esophageal wall of the nature of mechanical injuries, ulcerations, scars, or areas of necrosis, the result of obliterating endarteritis. Kraus opposes the latter view of Brosch, and believes that either unusually forcible contractions of the lower third of the esophagus or abnormalities in the vomiting act are the only two possible etiological factors. The abnormality in the vomiting act, he thinks, consists in a failure of the cardia to open and permit the egress of gastric contents. Under these conditions, he says, the force of contraction of the abdominal wall and the diaphragm would exert itself entirely upon the cardia and lower end of the esophagus. The remaining observers incline to either one of these former views, without, however, presenting any evidence to strengthen any one of them.

DISEASES OF THE STOMACH.

The past year has not brought forth anything that is strikingly new in direct connection with diseases of digestion, but there has been a good deal of activity in the study of the manner in which the motor functions, especially, are carried on in the stomach, and some of this work is of direct significance to the clinician and goes far toward altering some of the conceptions upon which our treatment has been based.

The studies relating to the manner in which hydrochloric acid becomes distributed in the stomach contents are of much interest in relation to treatment and also in relation to the limitation of value of test meals as an absolute index of the secretory activities of the stomach. Cannon's summary of his work on the manner in which the control of the pylorus is carried out is of particular interest.

Physiological Considerations. One of the most important contributions to the physiology of the gastro-intestinal tract, and one that will

have important bearings upon clinical conceptions of gastric disease and especially upon treatment, is comprised in Cannon's article on "The Acid Control of the Pylorus." This is a general discussion of a number of articles published by this investigator within the past few years. Numerous hypotheses have been set forth to explain the manner in which the stomach empties itself. The view of Richet and Rossbach, that food remains in the stomach for three or four hours, until it is thoroughly mixed with gastric juice, before any of it passes out of the pylorus, has been discarded. Clinical and experimental studies, as well as Cannon's own investigations, have proved that the stomach empties itself progressively from shortly after the time when food is first received into it until it is entirely empty. This, however, does not mean that this process of emptying is a continuous one, but that the discharge is occasional, and occurs not with the advent of each peristaltic wave, but at irregular intervals.

Both mechanical and chemical agencies have been invoked to explain the relaxation of the pyloric sphincter and the emptying of the stomach. Those who claim mechanical agencies in the stomach to be active in this process of discharge believe that the pressure of the peristaltic waves, though withstood by the pylorus in the earlier stages of digestion, becomes progressively stronger and stronger, and finally, after two or three hours, overcomes the resistance of the pyloric sphincter. However, it has become conclusively proved that food does not remain in the stomach for two or three hours without any of it being discharged. Moreover, investigation by means of the x -rays has shown that the constriction rings of the peristaltic waves do not become progressively deeper, but remain of practically the same depth throughout the entire stage of gastric digestion.

Von Mering and Marbaix thought mechanical agencies in the intestines to be responsible for the control of the pylorus. They found that filling the upper portion of the small intestine by injections through fistulæ so as to form a continuous content in this portion of the tract inhibited the discharge from the stomach. But, as Cannon has shown, a continuous intestinal content is not normal; and the findings of von Mering and Marbaix, consequently, have but little bearing upon the physiological aspects of the question.

Of those who have considered chemical agencies in the stomach to be active in inducing the opening of the pylorus, Ewald and Boas were among the first to observe that there was a considerable development of free hydrochloric acid before the gastric contents began to be notably diminished in amount. What the actual effect of this acid development was they did not determine. Penzoldt, in studying the time that various foods remained in the stomach, noted that food delaying the appearance of free hydrochloric acid remained longest in the stomach. His experiments, however, were not conclusive. Chemical agencies in the

duodenum were thought to be concerned in the evacuation of the stomach by Hirsch, who observed that inorganic acids left the stomach slowly, and by Serdjukow and Tobler, who showed that gastric evacuation was inhibited by introducing acid into the duodenum through a fistula.

All these observers failed to recognize that two factors are concerned in gastric evacuation. One of these is the pressure to which the food at the pylorus is subjected by the recurring peristaltic waves; the other is the action of the pyloric sphincters. Cannon has shown that gastric peristaltic waves of practically the same intensity are continuously running, so long as food remains in the stomach. One of the two factors, the pressure in the antrum, is, therefore, recurrently constant; and the control of the discharge must consequently reside with the other factor, the action of the pyloric sphincter. The substance of Cannon's work is the explanation of this action, as well as the differences in the rate of discharge of different foodstuffs from the stomach. It has been shown that when representative carbohydrate, proteid, and fatty foods of uniform amount and consistency are separately fed to an animal, the carbohydrates begin to leave the stomach within ten minutes after ingestion, and are passed out rapidly. Proteids commonly do not leave the stomach at all during the first half-hour, and sometimes not for an hour, and then they are expelled only slowly. Fats, because of a continuous slow exit, remain in the stomach for a long period.

The earlier investigators whose views have been presented have regarded factors in the stomach or factors in the intestines as controlling gastric evacuation. Cannon's view is that there is an interaction of agencies; that a single stimulus acts first in the stomach, and later in the duodenum. His theory is presented so clearly and so concisely that I shall quote the next few paragraphs directly from his article:

"The first statement in the theory is that acid coming to the pylorus causes a relaxation of the sphincter. Thus would be explained why the initial discharge is longer delayed when proteids are fed than when carbohydrates are fed. Both carbohydrates and proteids stimulate gastric secretion in abundance, as researches on dogs by Pawlow and his co-workers, and as clinical studies on men have shown. Inasmuch as carbohydrates do not unite chemically with the acid, free acid is at once present in the stomach; and carbohydrates would, therefore, begin almost immediately to pass through the pylorus. Proteids, on the other hand, join with the acid, and thus retard for some time the development of an acid reaction. The proteid discharge would, therefore, be retarded.

"But acid on the stomach side of the pylorus is not the only determinant of pyloric action. This is proved by feeding carbohydrate food, moistened with 0.4 per cent. hydrochloric acid. The rate of discharge is not increased. If acid in the stomach is the stimulus relaxing the pylorus, why, in this case, is the rate of discharge not increased? The

observations of Hirsch and Serdjukow now have their bearing. Since it has been shown that acid in the duodenum does not stop gastric peristalsis, the acid reflex from the duodenum must affect the pyloric sphincter. The second statement in the theory naturally follows—acid in the duodenum closes the pylorus.

“It is probable that the pyloric sphincter has normally a greater or less degree of tonic contraction, with occasional relaxations. Certainly it has a tonic contraction, persistently strong for some time after food enters the stomach; when proteid, for example, is fed, peristaltic constrictions may press the food against the pylorus repeatedly for an hour (approximately, three hundred waves) without forcing food through the orifice.

“The whole theory of the acid control of the pylorus may now be stated. The pylorus is tonically closed when food is ingested, and remains closed against recurrent pressure. The appearance of acid at the pylorus causes the sphincter to relax. The pressing peristaltic waves now force some of the acid chyme into the duodenum. The acid in the duodenum at once tightens the sphincter against further exit. The same acid also stimulates the flow of alkaline pancreatic juice. Since no inorganic acid is normally present beyond the first few centimeters of the small intestine, and since the acid reaction of the contents in this uppermost region is replaced throughout the rest of the small intestine by practically a neutral reaction, the acid chyme must be neutralized soon after its emergence from the stomach. As neutralization proceeds, the stimulus closing the pylorus is weakened; now the acid in the stomach is able again to relax the sphincter. Again, the acid food goes forth and immediately closes the passage behind it, until the duodenal processes have undergone their slower change. And thus repeatedly until the stomach is empty.”

Cannon presents numerous experiments to substantiate his views. As has been mentioned, carbohydrate food commences to leave the stomach soon after ingestion and continues to do so rapidly until the stomach is empty. This action is supposedly due to the fact that carbohydrate, although stimulating the secretion of acid, does not unite with it. Cannon determined the rate of expulsion of a certain amount of carbohydrate food moistened with a definite quantity of water. He then performed the same experiment, moistening the food with a 1 per cent. sodium bicarbonate solution, instead of with water. Comparison of the results of the two experiments showed that at the end of a half-hour there had emerged only about one-tenth as much of the food wet with the alkaline solution as of the same food wet with water; at the end of an hour, from one-third to one-half as much; and in two hours from about one-half to five-sixths as much. In other words, there was a marked retardation in the discharge of carbohydrates wet with the alkaline solution.

The reverse experiment was performed with proteid food. Proteid, as has been mentioned, leaves the stomach slowly, starting to do so from a half-hour to an hour after ingestion. This slow evacuation is due to the fact, according to Cannon's views, that the proteid readily combines with the acid, and continues to do so until it is sufficiently saturated, when free acid commences to be present. If this be true, then the administration of acid with the proteid should hasten the evacuation. After determining the rate of evacuation of a given quantity of proteid, when fed to a number of animals, the same experiment was repeated with proteid allowed to stand in 10 per cent. hydrochloric acid, after which the free acid was dialyzed away until tests showed none present. The result showed that at the end of a half-hour the stomach had discharged from five to ten times as much acid proteid as natural proteid; three to ten times as much at the end of an hour; and in two hours, about twice as much acid proteid as natural proteid.

The next experiment was the determination, by means of a fistula in the pyloric antrum, whether the appearance of acid in the antrum closely precedes the initial discharge. This was consistently found to be the case. Moreover, it was determined that any delay in the appearance of acid in the antrum is associated with a similar delay in the passage of food from the stomach, and that this may occur in spite of vigorous gastric peristalsis. If, under these circumstances, a small amount of acid is introduced into the antrum the pylorus immediately opens. Similar results were obtained on the excised stomach.

The next experiments were performed with the hope of determining whether acid in the duodenum keeps the pylorus closed. The experiments of Hirsch, Serdjukow, Tobler, and Lang presented strong evidence to this effect. As the acid chyme is neutralized soon after arriving in the duodenum by the alkaline pancreatic secretion and bile, their absence would naturally prevent this neutralization, and, according to Cannon's theory, the unneutralized acid chyme would prevent the pylorus from opening. The expulsion of food from the stomach would, under these circumstances, be much slower than normal. Cannon, therefore, ligated the larger pancreatic duct and the common bile duct in a dog, and found that after this operation the exit of food from the stomach was much slower than normally—one-fourth the normal amount in an hour; one-third the normal amount at the end of two hours.

It was finally found that destroying the continuity between the stomach and the duodenum hastens gastric discharge. These experiments were performed by cutting the intestines about 1.5 cm. below the pyloric furrow, and anastomosing the gastric end of this with the intestines about 30 cm. lower. Under these circumstances, when the animal was fed with beef the food left the stomach much more rapidly than normally, an occurrence undoubtedly the result of the absence of the

duodenum, the acid reflex in which would normally tend to close the pylorus and retard the evacuation from the stomach.

One of the anatomical peculiarities of the stomach, namely, that acid is secreted only in the fundal portion of the stomach, is nicely in harmony with Cannon's theory. If acid were secreted in the antrum the pylorus would open as soon as secretion started; since it is secreted in the fundus, however, it is only when food, sufficiently acidified, is brought from this portion of the stomach to the antrum that the pylorus opens and permits the properly prepared food to pass through.

Among the phenomena not evidently in harmony with the view that acid on the stomach side opens the pylorus are the facts that water and egg albumin, which do not call forth a strongly acid secretion, pass through the pylorus rapidly. It appears, however, from Cannon's experiments that substances that do not call forth an acid secretion decrease the pyloric tonus, and this probably explains their rapid evacuation. That fats are slowly discharged from the stomach, a fact which, as has been determined by numerous investigators, is probably the result of two factors: first, that fats do not promote a very acid secretion; second, that as soon as they are discharged into the intestines and are acted upon by the steapsin of the pancreatic juice, fatty acids are liberated, which tend to close the pylorus.

In regard to pathological cases, which do not seem in harmony with Cannon's view, he emphasizes the fact that his experiments have been upon only the physiological aspects of pyloric control, and not upon the conditions that may obtain in altered states of secretion and motility. Therefore, it may be impossible in some particulars to apply his work directly to some disorders of the stomach, but, nevertheless, it will certainly help to clear up many points that have been ill explained, and it will especially tend toward a more definite determination clinically whether changes in reaction of the stomach contents, changes in pyloric tonus, or direct disorders of motility are the cause of disturbances in the evacuation of the stomach in individual cases.

VARIATIONS IN DIFFERENT PORTIONS OF THE STOMACH CONTENTS. Cannon's work does not concern itself with variations in the consistency of the food and any differences in the pyloric reflex that may result from these variations. It was formerly thought that the pylorus itself undertook the sorting of food in regard to its passage into the duodenum, permitting the passage of fluid contents, but closing when solid particles approached it. Newer views, however, indicate that the separation of the solid from the fluid particles is a function of the entire stomach. The newer developments in this question are presented by Prym.¹ Although it was demonstrated long ago by Gürtzner that the stomach contents of animals is in the form of concentric layers, until the very

¹ Münch. med. Woch., 1908, lv, No. 2, p. 57.

recent past clinicians in general have held the view that there is a thorough admixture of the ingested food and the gastric juices. Prym, following the method employed by Grützner, of killing dogs shortly after the ingestion of various foodstuffs and immediately freezing the stomach, was able to show that there is not only a layer-like arrangement of the stomach contents, dependent upon their various consistencies, but that the various layers differ decidedly in their acidity. The foodstuffs in contact with the gastric mucosa contain considerable amounts of hydrochloric acid, those farther removed from it containing less, and those in the centre of the mass being practically free from hydrochloric acid.

In determining the relations of the various layers as characterized by their different consistencies, dogs were fed with soup and pieces of meat. When the meat was given first, followed later by the soup, thirty-five minutes afterward the meat was found in the form of a single mass surrounded on all sides by the soup. However, when the soup was given first and followed by the meat, the pieces of meat were found, after thirty-five minutes, distributed rather homogeneously throughout the soup. When, under the same conditions, the stomach was examined one and a half hours after the feeding, again the meat was found in the centre, surrounded on all sides by soup. Considering the results of the various experimental methods that have been employed, Prym considers the phenomena to be somewhat as follows:

The outermost portions of the stomach contents in contact with the gastric mucosa of the fundus are digested and liquefied by the action of the hydrochloric acid and pepsin. The peristaltic wave, commencing at the cardiac end of the stomach, forces the digested portion toward the pylorus until, as the wave reaches the antrum pylori, it becomes so deep as to form a total constriction separating the antrum pylori from the remainder of the stomach. If, now, the pylorus opens, the acidified content of the antrum is ejected into the duodenum.

If solid particles should come into contact with the gastric mucosa, instead of being taken up and carried on to the pylorus, the peristaltic waves cause the soft mucosa to slip over it, as it were, and thrust it toward the centre of the stomach. If digestion and liquefaction of the ingesta do not keep pace with the emptying of the stomach, naturally some solid portions must be taken up and thrust into the duodenum. If the emptying is delayed, as in pyloric stenosis, more and more acid fluid contents gather.

HYDROCHLORIC ACID IN GASTRIC CONTENTS. Taussig and Rush¹ made a number of observations to determine the clinical importance of the uneven distribution of hydrochloric acid in the gastric contents. They found that it was impossible by the ordinary means

¹ Boston Medical and Surgical Journal, 1908, clviii, No. 3, p. 79.

of expression and aspiration to obtain all of the stomach contents. In a series of cases, after removing all that was possible by these means, the patient was made to lie first on his back, then on his right side, and the contents were obtained in the latter positions by expression and aspiration. In a series of cases they found that by the latter means quantities varying from 17 to 65 c.c. could be obtained that could not be expressed in the erect position. By subsequently introducing a measured quantity of water they were able to obtain from 11 to 64 c.c. that could not be obtained in either of the former procedures. In studying the acidity of the first two portions removed in a series of 28 cases after an Ewald-Boas breakfast, they found that the two portions were in fairly good agreement eleven times. The first portion was decidedly more acid than the second fourteen times, the reverse being true three times. In one case, the difference in the total acidity of the two portions was more than fifty. They noted that after a Riegel dinner the acidity of the two portions was more frequently nearly uniform than after the Ewald-Boas breakfast. The same was true of the Sahli flour and butter soup. On the basis of their experiments, Taussig and Rush take an extremely unfavorable view of the value of gastric analyses as ordinarily practised. Prym does not share their views in regard to the Ewald-Boas test breakfast, which he thinks retains the clinical importance that years of usage have ascribed to it, but is more skeptical of the value of estimations after the ingestion of the Sahli soup. The suggestion of Taussig and Rush to obtain the stomach contents in both the erect and prone positions may, however, prove to be of some use in practice.

Prym calls attention to the fact that long-established customs in regard to the rotation of foodstuffs in our daily meals finds its explanation in the recent scientific facts that have been established in gastric motility and digestion. Soup, with which the usual meal commences, does not dilute the gastric juice, but merely stimulates the secretion of acid and then passes quickly into the intestines, furnishing the organism with water and chlorine for the formation of more juice. It may be added that the carbohydrates with which we frequently end the meal, being last to enter the stomach, are consequently not acidified until late in the process of digestion, and can be acted upon by the ptyalin in the saliva that is subsequently swallowed.

The rapidity with which water, salt solutions, and possibly some other liquids pass from the stomach was observed in both Prym's experiments and those of Cohnheim.¹ Even when the stomach is full of other contents, ingested water seems to pass into the intestines immediately, without mixing with the other contents. This is apparently made possible by a horseshoe-like band of muscle running along the lesser curvature of the

¹ *Munch. med. Woch.*, 1907, liv, No. 52, p. 2581.

stomach from the cardia to the pylorus. This muscular band seems to contract and form a sort of gutter through which the water can flow without coming into contact with the remainder of the stomach contents.

Psychic Influences upon Digestion. Two of the interesting contributions of the past year add evidence that the recent observations of the Pawlow school on the physiology of gastric secretion, as determined in animal experimentation, hold good also for man. Kaznelson¹ performed experiments on a woman aged thirty-one years, with both a gastric and an esophageal fistula, which had been made on account of a complete esophageal stricture. The experiments were, in the main, repetitions of those practised by Pawlow and his school in determining the psychical element in gastric secretion in animals.

The patient was allowed to eat various substances, especially meat, which, instead of passing into the stomach, passed out of the upper end of the divided esophagus. Five minutes after the beginning of the experiment the gastric secretion commenced, and continued as it did in the animal experiments. Either before or during the process of feeding numerous stimuli were applied to either the sense of smell or that of taste, and found to have profound influence either in the direction of increasing or decreasing the secretion. Bitter tonics applied to the tongue during the process of secretion were found to increase it. Solutions of sodium bicarbonate greatly decreased the secretion of acid. The main conclusions to which the author comes are that various stimuli of taste and smell are able to effect a secretion in the resting stomach or to increase or decrease the secretion of an active stomach. The purely mechanical act of chewing calls forth no gastric secretion. The gastric juice contains a fat-splitting ferment. The acidity of the pure gastric juice in man is relatively constant, although the quantity of the gastric juice undergoes considerable variations.

The observations of Boger² were made upon a three-and-a-half-year-old child with a gastric fistula on account of an esophageal stenosis. X-ray examination showed the esophagus above the stenosis to be considerably dilated. The object of the experiments was to determine how powerful an associated stimulus might be in calling forth the gastric secretion. The child was fed with meat, which he was able to swallow and hold in considerable quantity in the dilated esophagus. Shortly after the start of the feeding, a secretion of gastric juice was observed. Each time, as the child was fed, peculiar blasts on a trumpet were blown, out of sight of the child. This was continued for a number of feedings, when finally the trumpet was blown without, however, any meat being given the child, and quite as powerful a secretion was ob-

¹ Arch. f. d. gesammte Physiol, 1907, cxviii, 327.

² Pflüger's Arch., 1907, cxvii, 150.

served as when the meat was given. During the experiments numerous other manifestations of psychical effect on gastric secretion were observed. Once, during secretion, the child was intentionally made angry, when the secretion immediately decreased to almost nothing. The effect of a visual associated stimulus was determined when the child, fed usually by one nurse, immediately exhibited a gastric secretion when it saw this nurse in conference with the experimenter; whereas, the sight of other nurses had no such effect.

Some of these observations were perhaps mere coincidences. At any rate, it would be overstrained to dwell too strongly on some of them. But that some of the effects were due to the stimulus used cannot be doubted, and the constantly multiplying evidences that psychic stimuli have important effects upon digestive processes give proper emphasis to the fact that has long been known through daily experience, although rarely sufficiently appreciated, namely, that if digestion is looked upon as a purely vegetative process digestive disorders will be poorly understood and badly treated.

Pancreatic Juice in the Stomach. Boldyreff¹ presents some new and rather startling views, and experiments based upon them, in regard to bile and pancreatic juice and their presence in the stomach. He has, in fact, discussed the same subject before, but his observations are so interesting that I shall give them in some detail.

It has long been considered that digestion in the stomach is accomplished solely through the action of the gastric secretion, together with the inconsiderable action of the saliva that may be swallowed. According to Boldyreff, the subject is, however, by no means so simple as this. Under certain conditions, considerable amounts of pancreatic secretion, together with bile and succus entericus, make their way into the stomach; and stomach digestion then takes place by reason of their activity, the activity of the pepsin being entirely destroyed. It is not by reason of chance reversed peristalsis that this occurs, but it occurs with much regularity after the ingestion of fats, when there are large amounts of free acid in the stomach, which may be either hydrochloric or organic acids, and occasionally into the empty stomach with alkaline reaction.

Occasional references to this possibility have been made in the past, especially by Boas and Tschlenoff, who, with the aid of a stomach tube, after having washed out the stomach with a soda solution and applied massage, were able to obtain fluid containing intestinal ferments; and Contejean thought that he was able to recognize the splitting of fats by pancreatic secretion in the stomach. Nevertheless, it has been looked upon as practically an axiom that the pancreatic juice travels only downward in the intestinal tract. It is well known that bile may find its way into the empty stomach, as manifested by green vomiting and

¹ Pflüger's Arch., Band cxxi, Heft 1 and 2.

bitter taste of the vomitus; but this has always been looked upon as only an occasional chance occurrence. Pawlow also called attention to the possibility of pancreatic digestion in the stomach, especially after the introduction of oil into the stomach.

We have learned, especially through the work of the Pawlow school, that the introduction of fat into the stomach has a profound influence in decreasing the gastric acidity, the pepsin, and the amount of gastric secretion. Wirschubsky showed that the digestive activity of the stomach contents after feeding an animal with meat and fat or bread and fat was but 66 per cent. of that which was observed when meat or bread was fed without fat; and the total quantity was but 74 per cent. of that observed when meat or bread was fed without fat. Consequently, the true peptic power of the secretion after feeding meat and fat or bread and fat was less than one-half what it was when these substances were fed without fat. It was, furthermore, determined by Lintwareff that fat decreases the motor activity of the stomach. In other words, it remains in the stomach longer than do other foods.

Various investigations have shown that fat is a profound excitant of the flow of pancreatic secretion and bile. As fat is difficult to digest, and requires much time for this process, it is probably an accommodation of nature to permit the normal function of the stomach to be somewhat altered, and thus allow the digestion of fats to take place in it. Naturally, the bile and the pancreatic juice, both alkaline secretions, greatly reduce the acidity of the stomach secretions, and consequently inhibit their peptic activity.

Numerous experiments convinced Boldyreff of the accuracy of the view that gastric motility is delayed by the ingestion of fats, and that when they are present in the stomach, bile, pancreatic juice, and intestinal juice are poured into the stomach from the intestines. Similar experiments carried out on human subjects to a limited extent were suggestive, but not positive.

In his experiments on dogs with gastric fistulæ, Boldyreff found that after the introduction of oil into the stomach there was an undoubted flow of bile, pancreatic juice, and intestinal juice into the stomach. Its presence he determined by the yellow color imparted by the bile, by the chemical response of the gastric contents to tests for bile, by the presence of fatty acids that must have been the result of the action of the steapsin of the pancreatic juice and the bile, and by the fact that the gastric contents contained a ferment capable of digesting proteid in an alkaline medium. As pepsin is not active in an alkaline medium, he concludes that this digestion must have been due to trypsin; and consequently established the presence of pancreatic juice in the stomach.

As acid is another active stimulant to the flow of pancreatic juice, he introduced 100 to 200 c.c. of a 0.5 per cent. solution of hydrochloric acid into the dogs' stomachs, and after a short interval found bile, pancreatic

juice, and succus entericus to be present in the stomach, but in considerably smaller quantities than after the introduction of oil.

Speculating on the significance of the flow of intestinal ferments into the stomach, Boldyreff thinks it probably a simple attempt to reduce the acidity of the stomach contents so as to guard the intestines from the irritant action of too acid a medium. In support of this hypothesis is the fact observed by the experimenter, that as soon as the acidity of the stomach contents was reduced to 0.2 per cent. or 0.15 per cent., the flow of intestinal juices toward the stomach ceased. Finally, in the fasting dog, Boldyreff observed a periodical flow of bile, pancreatic juice, and succus into the stomach, in some cases amounting to as much as 80 c.c. in the course of an hour's time.

Boldyreff and one of his associates undertook to determine on themselves the flow of intestinal secretions into the stomach. To obtain the action of both acid and oil, they swallowed 75 to 80 c.c. of a 2 per cent. solution of oleic acid in olive oil. Removing the stomach contents by means of a stomach tube, after an hour to an hour and a half, they were able to demonstrate in it a proteolytic ferment active in an alkaline medium, as well as a fat-splitting ferment so active as to be attributable, according to their view, to only the pancreatic juice.

In a consideration of the clinical and pathological significance of this flow of intestinal secretions into the stomach, Boldyreff ventures the opinion that it may stand in a close etiological relationship to gastric ulcer. If there is any such connection, then the hyperacidity frequently found in patients with gastric ulcer is not the immediate cause of the ulcer, but a profound excitant to the flow of intestinal juices into the stomach, and the latter should be looked upon as the active cause of the ulcer.

If Boldyreff's observations are correct, they will have a decided bearing upon our interpretations of various tests employed for the estimation of the motor and secretory activities of the stomach. In determining the motor powers of the stomach, the amount of gastric contents obtained after the allotted time would depend very materially upon the amount of the juices flowing from the intestines into the stomach during this period. Moreover, as the intestinal juices are of alkaline reaction, the amount entering the stomach and the degree of its alkalinity would decidedly alter the acidity of the gastric contents. These facts apply more especially to those cases in which a fatty substance is employed in the determination, as in the Sahli soup test. Also, in the estimation of the motor activity of the stomach by means of salol, must the possibility of the salol being split by pancreatic juice in the stomach be considered. Finally, Boldyreff thinks that estimations of the secretory activity of the pancreas and liver can be made by examination of the stomach contents under conditions promoting the flow of bile, pancreatic juice, and succus entericus into the stomach.

Methods of Gastric Analysis. Various comparisons of the different methods of determining the efficiency of gastric or gastro-intestinal digestion have led to somewhat conflicting results. Tottman¹ studied a series of cases, some of them with gastro-intestinal disorders, others free from any involvement of the gastro-intestinal tract. He used Sahli's desmoid reaction, Schmidt's diet, and aspiration of the stomach contents. He concludes that aspiration is the most difficult and most unpleasant method; the results from it are valuable in well-marked cases of gastric disorder when taken into consideration with all the other factors; in less marked gastric disorders it is not capable of giving reliable results, and, in fact, may even lead to error, inasmuch as disturbances of function may be incident to the aspiration itself. Schmidt's test diet he considers to be general clinical practice an exceedingly valuable method. Errors from its use are seldom met with. Its repeated use in the same individual is not to be recommended, as patients readily acquire an aversion to the monotony of the diet; moreover, it is not qualified for use in those patients who can take no solid food. Sahli's desmoid reaction is the most satisfactory of the three methods from the patient's standpoint. The pills must be carefully prepared, with the best of material. Two pills should be given in each case. If the results of both of these are negative, the test is much more valuable than aspiration, and about equal in value to the Schmidt diet test. The significance of a positive result, however, is never so reliable, and must be carefully interpreted. The greatest value of the desmoid test lies in the simplicity and ease of its performance.

These conclusions are certainly overgenerous toward the desmoid reaction. It may have some value, but it will almost certainly come to occupy a limited sphere. Quick and easy methods rarely prove permanently valuable in so complex a question as the study of digestion, and the work of various observers has already had discordant results in relation to this reaction. I quite agree that the results of studying the aspirated stomach contents must be interpreted very cautiously, and it is generally recognized now that we must reckon with errors incident to the method and also with the fact that any change in the stomach contents may be due to varied causes, and a broad study of the case must determine the cause in each instance. The use of Schmidt's diet is undoubtedly of value, but it appears to me to be best of all to put the individual upon a diet suited to his actual needs, and of normal variety so far as he is capable of taking, and to determine by careful study of the feces how far he is capable, not of approaching a more or less artificial average standard, but of doing what he individually should do in the circumstances in which he

¹ Münch. med. Woch., 1907, No. 52, p. 2597.

must live and work. At any rate, much would be learned that is not now learned if the feces of every person who has digestive disturbance were studied when he is on *the diet that causes disturbance*. This is one of the simplest and most useful practices in such cases.

Hewes and Adler¹ undertook an exhaustive series of observations on normal individuals to establish the reliability of the results obtained from the *Schmidt diet*. They made quantitative determinations of the total nitrogen, total fat, and total carbohydrate of the feces, and of the total neutral fat, total fatty acid, and total soap, in each of the cases, in addition to performing macroscopic and microscopic examinations of the feces in respect to the quantity and character of the muscle fiber remains and the starch remains present. They studied, in all, eleven individuals, three of them children aged six years, two children aged twelve years, one child aged thirteen years, and five adults. The findings of meat remains, as revealed by the microscopic examinations of the feces, which serves as an index of the capacity of the individual to digest meat proteid, showed great uniformity in all cases. The findings in children and in adults were practically the same.

They conclude that, from the definiteness and the constancy of this finding in the normal, it would appear possible for any observer familiar with the normal findings to determine by microscopic examination in any given case, whether or not the findings were abnormal, and thus to diagnose the presence of a disturbance of meat digestion. The quantitative estimations of proteid utilization showed practically the same constancy. The results of their proteid estimations expressed in nitrogen excretion were as follows:

	Per cent.
Average finding in 17 examinations upon 11 individuals . . .	4.98
Minimum finding in 17 examinations upon 11 individuals . . .	4.41
Maximum finding in 17 examinations upon 11 individuals . . .	5.40
Extreme variation of all findings	0.99
Extreme variations found in 1 individual	0.41

The findings as regards fat absorption, determined by estimating the total fat content, indicate that the capacity of normal individuals for the utilization of food fat may undergo considerable variation. The extreme variations that they found were not a matter of one exceptional case; the maximum figure was approached in several cases, and the minimum in several. The following table shows the results of these estimations expressed in total fat contents of the feces:

	Per cent.
Average finding of 17 examinations upon 11 individuals . . .	28.5
Minimum finding of 17 examinations upon 11 individuals . . .	19.2
Maximum finding of 17 examinations upon 11 individuals . . .	39.5
Extreme variation of all cases	20.3
Extreme variation in a single individual	9.3

¹ Boston Medical and Surgical Journal, 1908, clviii, No. 19, p. 655.

The estimations of fat digestion, as determined by the proportion of neutral fat to total fat, gave fairly constant results in all the cases.

Estimations of the carbohydrate remains were made on seven individuals, two of whom were children. The findings in the adults and older children were fairly uniform, and those in the two children were almost equal. Comparing the average for the adults and that for the children, however, a decided difference was found, indicating that the utilization of carbohydrates is poorer in children than in older persons. The records of the carbohydrate excretion are shown in the following table:

	Per cent.
Average finding of 7 individuals	8.01
Minimum finding in 7 individuals	6.39
Maximum finding in 7 individuals	11.3
Extreme variation in all cases	4.81

The finding in regard to starch remains, as revealed by the microscopic examination of the feces, presented a striking uniformity in all the normal individuals examined.

Wurz¹ has compared the results of the *Riegel test meal*, the *Ewald test breakfast*, and the *Sahli soup* in a series of cases. In his judgment the Riegel test meal gives the most reliable diagnostic results. It almost invariably produced the highest acidity of the three methods. Wurz thinks that this is the result of the fact that the meal corresponds more closely to meals ordinarily taken by the patient, and the fact that it comes at mid-day. When one is unable to administer the Riegel test meal, he prefers the Sahli soup to the Ewald breakfast, for the reason that he has found it to give greater acidity than the Ewald breakfast. The greatest advantages of the latter are its ease of preparation and the fact that it is easily borne by the majority of patients.

These views are correct so far as they go. Undoubtedly the Riegel meal more closely simulates normal conditions, but at the same time the Ewald breakfast is vastly more commonly used, and will continue to be; and this is entirely proper, for while the results are somewhat less accurate, all results with test meals are merely approximate and furnish only a few facts among many upon which to base diagnosis or treatment, and the increased accuracy from the Riegel meal is not sufficient to offset the clumsiness in its use.

Palfrey² investigated a series of cases to determine the reliability of the *Sahli soup test*. In some of the cases he obtained results that were in harmony with the characteristics of the case, as determined by other clinical methods, operation, or autopsy. In other cases, however, evidently erroneous results were obtained. As examples, in a case of carcinoma of the pylorus, determined by exploratory laparotomy, the

¹ Deut. med. Woch., 1908, No. 24, p. 1055.

² Boston Medical and Surgical Journal, 1908, clviii, No. 19, p. 681.

test showed 340 c.c. of gastric secretion to have been produced during the time that the soup remained in the stomach. In another case, 300 c.c. of fluid were removed one hour after ingestion, and found to contain a percentage of fat, according to the calculation, higher than that of the soup ingested. Palfrey was able in only a few cases to administer the test more than once to the same individual while the gastric condition remained unchanged. In the cases in which this was done great variations in the results were obtained. Despite the unreliability of the test according to his results, Palfrey thinks that in cases in which every available method must be used to arrive at a diagnosis it is probably worthy of use.

On the basis of our present knowledge of the marked differences of the acidity in the different layers of the stomach contents, the unreliability of the Sahli soup test can be readily appreciated, a fact to which Prym, in the above-mentioned article, calls attention.

The Estimation of Pepsin. Within the past few years clinicians have come to the recognition of the fact that pepsin may not always be altered in the stomach secretion in harmony with the alterations in the quantity of hydrochloric acid, and attention has been turned to estimations of pepsin in relation to the diagnosis of both organic and functional gastric disorders. The methods that have been previously used have either not been generally recognized as being of great accuracy, or have been too complicated for clinical use, although it is true that Pawlow and his followers have placed considerable reliance upon the Mett method. Within the last year three methods have been proposed which, on account of their relative simplicity and, so far as investigations up to this time indicate, on account of reasonable accuracy, bid fair to come into some use. All three methods are somewhat similar in principle.

The method of Jacoby and Solms¹ is based upon the fact that a solution of *ricin* becomes cloudy in the presence of hydrochloric acid, and changes to a clear solution on the addition of a sufficient quantity of pepsin. The solutions necessary for the performance of the test are a 1 per cent. solution of ricin in a 5 per cent. solution of sodium chloride and a decinormal solution of hydrochloric acid. The gastric juice is obtained by aspiration one hour after an Ewald-Boas test breakfast. The total acidity and the free hydrochloric acid are determined first, for various dilutions are made, according to the degree of acidity. In hyperacidity, Solms uses dilutions of 1 to 100 to 1 to 10,000; whereas, in hypoacidity, from 1 to 10 to 1 to 100. The method of performing the test in a case in which the acidity is found to be approximately normal is as follows: 2 c.c. of the filtered ricin solution are placed in each of five test tubes. To each of these is added 0.5 c.c. of the decinormal HCl solution, whereupon the solution becomes cloudy. To the first

¹ Zeitsch. f. klin. Med., 1907, lxiv, p. 159.

of the test tubes is added 1 c.c. of boiled gastric juice (the peptic activity of the gastric juice is destroyed by the boiling); to the second is added 0.9 c.c.; to the third, 0.8; to the fourth, 0.5; and none to the fifth. The gastric juice whose peptic activity is to be tested is then diluted with distilled water in the proportion of 1 to 100, and added to the tubes as follows:

To tube No. 1, 0; to tube No. 2, 0.1 c.c.; to tube No. 3, 0.2 c.c.; to tube No. 4, 0.5 c.c.; and to tube No. 5, 1 c.c. Thus each tube contains 3.5 c.c. of fluid. The tubes are then corked and placed in the incubator. After three hours they are taken out and it is determined in which dilution the mixture has become entirely clear. In the absence of an incubator the determinations can be made in room temperature after a proportionately longer time. The denominator of the fraction of dilution divided by the number of cubic centimeters of diluted contents required to clear the solution thus expresses the peptic activity of the gastric juice that is being examined. In other words, if, in the dilution of 1 to 100, 1 c.c. clears the solution, the peptic activity is expressed as being equivalent to 100. If 0.5 c.c. of the gastric juice diluted 1 to 100 is sufficient to clear it the peptic activity is 200.

For the sake of convenience a peptic activity of 100 units is designated as normal; for, after numerous investigations by Solms, of gastric juices with normal acidity, 1 c.c. of a dilution of 1 to 100 was found to clear the ricin solution used after three hours in the incubator.

Solms places the limits of normal peptic activity between 100 and 200 units. In studying a large series of cases with subacidity the peptic activity varied between 10 and 20 units. In cases of hyperacidity the variations in pepsin units were from 100 to 1000; but it was found that hyperacidity was by no means always accompanied by increased peptic activity. In five cases of *pernicious anemia* the author found three to have less than 10 peptic units, one almost 10, and one exactly 10. Of ten cases of *gastric ulcer*, one had 1000 units, one, 500 units, five, 200 units, one, 100 units, and one not quite 100 units. In a number of cases of *carcinoma of the stomach*, as well as in two cases of *carcinoma of the gall-bladder*, the peptic activity was greatly reduced. He does not give the numerical results in these cases.

Witte¹ investigated a large series of cases with the method of Jacoby and Solms, and, with the exception of the fact that he obtained somewhat lower values in the gastric juices with normal acidity, had results which in general coincided with those of Solms. He calls attention to the fact that occasionally the method may lead to error, on account of the impossibility of filtering some gastric juices until they are clear. Witte thinks that the scientific accuracy of the test is interfered with by the fact that in the different dilutions the same degree of acidity is not

¹ Berl. klin. Woch., 1907, Nr. 42, p. 1338.

always obtained; and, as is known, the maximum degree of peptic digestion is obtained in a constant acidity of about 0.2 per cent. He therefore recommends for scientific investigation the employment of a uniform acidity in all of the tubes. This, however, is not necessary in general clinical work. Witte looks upon the test as inexpensive, easily manipulated, and sufficiently exact.

The method of Fuld and Levison¹ is similar to that of Jacoby and Solms. The necessary solutions are as follows: A 1 to 1000 solution of *edestin*, an albumin derived from hemp, in a solution of HCl of the acidity of 30. The latter is readily prepared by adding 30 c.c. of decinormal HCl to 70 c.c. of distilled water. The same HCl solution is used to dilute the filtered gastric juice in the proportion of 1 to 10 or 1 to 20. The method is as follows: In a series of test tubes increasing quantities of the diluted gastric juice are placed as follows: In the first, 0.1 c.c.; in the second, 0.16; in the third, 0.25; in the fourth, 0.4; in the fifth, 0.64; and in the sixth, 1. To each of the tubes is then added 2 c.c. of the edestin solution, and the tubes are allowed to stand for half an hour at room temperature. At the end of this time a definite quantity of sodium chloride is added to each of the tubes, and observations are made as to which of the solutions become cloudy. In the first tube in which the solution after the addition of sodium chloride remains clear all the albumin is digested. The principle upon which the method is based is as follows: In the presence of HCl, edestin is changed to edestan, which is insoluble in a neutral salt. Its products of digestion, however, are soluble. The calculation of the peptic activity can be best understood by offering an example. If 0.25 c.c. of the gastric juice diluted twenty times is capable of digesting 2 c.c. of the edestin solution, the following formula results:

$$\frac{0.25}{20 \times 2} = \frac{1}{160}.$$

In other words, the peptic activity of this gastric juice was 160. The peptic activity of normal gastric juice is estimated at 100 units.

Fuld and Levison claim the advantages of their method over the ricin method to be the simplicity of the materials, the clearness of the result, and the shortness of the time consumed in its performance.

Wolff and Tomaszewski,² studying a large series of cases with the edestin test, agree with the originators of it as to its value, and arrive at practically the same results in their investigation. These results do not differ materially from those obtained by Solms and Witte, using the ricin test.

Reicher³ investigated the delicacy of the edestin and ricin tests with

¹ Biochem. Zeitsch., 1907, vi, Heft 5 und 6.

² Berl. klin. Woch., 1908, Nr. 22, p. 1051.

³ Wien. klin. Woch., 1907, Nr. 48, p. 1508.

Merck's pepsin. He found that 0.000021 gram of pepsin cleared the solution in the ricin method; whereas, with 0.000017 gram of pepsin there was no cloudiness in the edestin test.

Gross¹ has originated a method for the estimation of pepsin which is similar to the foregoing methods, but seems to possess no advantages over either of them. The method is as follows: One gram of pure *casein* is dissolved on a water-bath in a mixture of 16 c.c. of a 25 per cent. HCl solution and one liter of water. Ten c.c. of this solution, previously warmed to from 29° to 40° C., are placed in each of a series of test tubes, to which are added increasing quantities of the gastric juice to be examined. These are then placed in an incubator for fifteen minutes, when they are taken out, and a few drops of a concentrated solution of sodium acetate are added to each tube. The undigested casein falls as a precipitate; whereas, the tubes in which the digestion of the casein has been complete, remain free from precipitate. The smallest quantity of gastric juice capable of digesting the casein in fifteen minutes may thus be calculated. The peptic activity of the gastric juice, expressed in units, is determined by inverting the fraction of 1 c.c. of gastric juice required. For example, if 0.25 c.c. of gastric juice has digested all the casein in one of the tubes, this gastric juice is expressed as having a peptic activity of 40 units. The author gives his results of the investigation of several cases, but expresses no very definite conclusions.

Gross' experiments led him to believe that the so-called Schutz-Borissow law in regard to the action of pepsin, that its activity is as the square of the quantity present, is not correct. He found the activity of pepsin, as well as of trypsin, to be directly proportionate to the amount of the ferment present, as well as to the time of its action.

It will be interesting to see the future of pepsin estimations in relation to clinical work. It appears probable that they will serve merely to help to indicate the degree of disturbance of secretion. It is not probable that any special types of disease or any particular line of treatment will be permanently built upon variations in the pepsin of the stomach contents.

Excretion of Pepsin in Urine. Wilenko² presents the results of interesting experiments on the excretion of pepsin in the urine. The experiments of Leo, Mya and Belfanti, Hoffmann, Benderski, Thiele, and Stadelmann indicate that the morning urine of healthy persons contains more pepsin than does that of the other portions of the day, and that diabetics especially excrete considerable quantities of pepsin in the morning urine. All the above-mentioned experiments with the exception of Leo's were performed with the morning urine alone. Wilenko's experiments were performed on twenty-four-hour urine, with the use of

¹ Berl. klin. Woch., 1908, Nr. 13, p. 643.

² Ibid., Nr. 22, p. 1060.

the Jacoby-Solms method. He paid especial attention to the comparative quantities of pepsin in the urine and the gastric contents. Observations made upon himself showed that with mixed, carbohydrate, or proteid diets the pepsin content of the urine was subject to considerable variations. On the carbohydrate diet the excretion was somewhat less than on either of the other two diets. His experiments on diabetics showed that there was not an increased excretion of pepsin in this disease when the twenty-four-hour quantity of urine was studied.

His studies of cases of gastric disease resulted in the finding that in some cases alterations in the amount of pepsin in the gastric contents coincided with alterations of the amount in the urine; whereas, in other cases the amount in the gastric contents was relatively much greater than that in the urine. These investigations were especially interesting in view of their indicating that the amount of pepsin in the urine is dependent not so much upon the amount of pepsin secreted into the stomach as upon the amount that the gastric cells discharge into the lymph spaces or bloodvessels. He was able to demonstrate on himself that the amount of pepsin in the urine is not dependent upon the amount in the intestinal tract, by ingesting a large amount of pepsin and acid without its having any influence upon the amount in his urine. His views are in thorough harmony with those of Grober, to the effect that the pepsin in the urine is not the result of absorption from the alimentary tract.

It is generally believed, especially on account of the fact that more pepsin is contained in the morning urine than in other portions, that the pepsin finds its way to the urine only when it is not secreted in the stomach. This is apparently not correct, for Wilenko observed cases of hypersecretion with increased quantities of pepsin in both gastric contents and urine; and as Matthes' experiments on dogs with extirpated gastric mucosa show, there is no other source for the pepsin of the urine than the stomach.

Wilenko looks upon the results of his experiments as being of especial significance in indicating the existence of conditions of the gastric mucosa in which it has lost the power of secreting pepsin into the cavity of the stomach, but in which it retains the power of discharging it into the tissue juices. This is of especial importance in connection with *apepsia gastrica*. It seems quite possible that the destruction of large areas of gastric mucosa, as occurs in carcinoma and gastric atrophy, would manifest itself by a decrease in the amount of pepsin in both gastric juice and urine. If this be the case, a comparison of the amounts of pepsin in the gastric secretion and the urine would assume considerable diagnostic importance. Only subsequent investigations, combined with post-mortem observations, will be able to determine this question.

The newer, more easily manipulated methods of estimating peptic activity are largely responsible for the numerous investigations that have recently been published upon questions dealing with the secretion of

pepsin. In addition to those already mentioned are the investigations of Rosenstern¹ on the secretion of pepsin in healthy and sick infants. The question of the character of test meal to administer was one that presented some difficulty. Tea was finally found to be, in all respects, a satisfactory stimulus to gastric secretion. Fifty c.c. of tea sweetened with saccharin were given to the infants between 7 and 8 A.M., and aspirated ten minutes later. The conclusions were that the peptic activity of healthy artificially nourished infants increases with increasing age to about the end of the third month of life, from then on remaining fairly constant; that healthy breast-fed infants produce less pepsin than artificially nourished infants of the same age; that poorly nourished infants secrete pepsin according to their age, and not according to their size; that disorders of nutrition do not materially affect the pepsin secretion; only in the most advanced stages of gastrointestinal disorders does a decrease in the amount of pepsin appear to present itself; that lack of ferments does not play a very prominent part in either the symptomatology or the etiology of digestive disturbances of infants.

Influence of Oil upon Gastric Secretion. Cowie and Munson² performed a large series of experiments on a number of patients to determine, if possible, the nature of the effect of oil in decreasing gastric acidity. It was the view of Pawlow that the influence of fats and oils in decreasing gastric acidity is exercised through reflex central stimulation of the inhibitory nerves of the glands or the inhibitory centres of these nerves, and that the mechanical action of the oil is very subordinate. Cowie and Munson conclude, as the result of their experiments, that the mechanical effect of oil plays an important part in lowering the gastric acidity. They consider that oil acts mechanically in two ways: by covering the food and by covering the mucosa. Since food is a natural stimulant to the flow of gastric juice, if the food cannot come into direct contact with the gastric mucosa it will naturally not have so profound an effect in stimulating the secretion as if it acted normally.

The fact that oil may act in a mechanical way by covering the food is shown by their experiment of immersing three pieces of coagulated egg albumin of the same size in water, glycerin, and olive oil, respectively, and then placing them separately in tubes containing equal amounts of gastric juice and incubating them at body temperature. It was seen that by the time the control had been completely dissolved the glycerinized piece was about one-half digested, while the piece immersed in oil was only beginning to show the slightest change. Moreover, the fact that oil given either immediately before or immediately after a test meal does not bring about so marked a lowering of the secretions as when it is given half an hour before, as determined by their

¹ Berl. klin. Woch., 1908, Nr. 11, p. 542.

² Archives of Internal Medicine, 1908, vol. i, No. 1, p. 61.

experiments, indicates that there are more than reflex central inhibitory influences at work. They believe, however, that the reflex central action plays some part in the reduction of the acidity, and that this action is quantitative, the depression becoming greater as the amount of oil administered is increased. They found, also, that the inhibition of secretion from nervous, as well as from mechanical, influences was in proportion to the rapidity with which the walls of the stomach were covered with oil.

In summing up the clinical and experimental results of their observations, they conclude:

1. That olive oil and cotton-seed oil when given in connection with the usual test breakfast decreases the gastric acidity at the end of the hour and retards the evacuation of the stomach.

2. That the beginning of the secretion of hydrochloric acid is delayed when the oil precedes the meal; unchanged when oil follows the meal.

3. That the height of digestion is delayed when oil is given either before or after the meal.

4. That the height of secretion is lowered when oil precedes the meal; unchanged when oil follows the meal.

5. That if the progress of digestion is watched by the removal of small samples of stomach fluid at frequent intervals, it will be observed when oil precedes the meal by one-half hour that at the end of what is usually taken as the digestive period for a test breakfast (three-fourths to one hour) the acidity is distinctly lower, while as great a height as is present in the control meal is frequently reached some minutes later.

6. That the action of oil on the stomach functions is but temporary. It has no effect on subsequent meals unaccompanied by oil.

7. That the therapeutic value of oil is apparent. In suitable cases it is preferable to antacids, because of its caloric value. In hyperchlorhydria it should precede the meal; in hypochlorhydria it should follow the meal. In stasis and persistent slow evacuation it should be avoided. In hypermotility it may be given before, during, or after the meal.

8. That oil lowers the gastric secretion, both by reflex central inhibitory stimulation and by mechanical action.

The suggestions regarding the therapeutic use of oil are correct theoretically, and often succeed practically; but frequently the use of oil before meals disturbs the stomach and cannot be persisted in, while it is usually well received after meals, and frequently does good when taken at this time in hyperchlorhydria as well as in some other conditions. Unquestionably the effect upon the secretions is only a part of its influence and in many cases a subordinate part. The effect upon constipation is not uncommonly quite as important, and in the ill-nourished neurotic type of person with hyperchlorhydria the influence upon nutrition produced by the free use of oil is most important of all.

Size and Position of Stomach. In relation to the important question of the determination of the size and position of the stomach, Pfahler¹ in discussing this matter on the basis of Röntgen ray examinations takes the view that the normal stomach must be considered to be of the infantile type, the most important feature of which is that the pylorus is as low as the lowest portion of the organ. He recognizes, however, that in adults this is by no means the usual form. According to his description, the stomach of an average individual in the standing posture extends to or below the umbilicus. It is vertical for more than its upper two-thirds, and the lower pole is distinctly lower than the pylorus. It occupies the left side of the abdomen, except when distended. The pyloric portion extends from one to two inches beyond the median line to the right. That this type of stomach is found in adults more frequently than the type Pfahler looks upon as normal, he attributes to the assumption that the majority of individuals suffer from mild forms of gastropptosis. Profound symptoms are not present in most cases, for the reason that gastric motility is able to compensate for this error of position. The primary factor in this gastropptosis or gastro-enteropptosis is weakening or relaxation of the abdominal muscles. He thinks that this relaxation is indirectly the result of that type of thorax usually spoken of as the phthisical chest. As the abdominal muscles give way the viscera in the upper portion of the abdomen sink, and to compensate for this, Pfahler thinks, the diaphragm must descend, and the lower portion of the thoracic wall consequently moves inward. Based upon this assumption, Pfahler thinks that in many cases a phthisical chest may be transformed into one of normal type by strengthening and supporting the abdominal muscles.

In regard to retention and obstruction in gastropptosis, Pfahler believes that these are not the result of a kink in the pyloric portion of the stomach, but are the result of a kinking of the duodenum about an inch from the pylorus, where it becomes almost entirely surrounded by peritoneum. He has been able, in numerous instances, to recognize, by means of the Röntgen rays, the retention of particles of food between this kink and the pylorus, and he looks upon this fact as a means of diagnosis between gastropptosis with obstruction and malignant tumor of the stomach.

Schwarz² places a different interpretation upon this retention of foodstuff between the pylorus and the point where the duodenum becomes retroperitoneal. He looks upon it as a normal finding, and explains it as follows: The first portion of the duodenum, which is the portion seen to contain this food material, has a perfectly smooth inner surface, and permits of the ready ingress of material from the stomach. At the commencement of the descending portion, however, where the

¹ Journal of the American Medical Association, 1907, xlix, No. 25, p. 2069.

² Berl. klin. Woch., 1908, Nr. 24, p. 1142.

duodenum becomes retroperitoneal, the Kerkring folds of the mucous membrane appear; and these tend to narrow the lumen of the duodenum, and consequently to act as a hindrance to the passage of the duodenal contents. As Schwarz mentions, these anatomical peculiarities of the horizontal portion of the duodenum, its smooth mucous surface, and its surrounding peritoneal coat tend to bring it into close anatomical as well as physiological relationship with the stomach.

Groedel¹ takes a different view from Pfahler in regard to the normal stomach. He designates as the normal form approximately that which Pfahler calls the usual form, giving it the name "siphon stomach"—a term that expresses not only its form but its functional significance. In this type throughout its entire extent the stomach is of approximately the same width, narrowing slightly from above downward. In the extreme upper end is the fundus. The lower pole of the organ is considerably below the level of the pylorus.

If this be the normal stomach, as shown by the Röntgen rays, by what characteristics can we recognize the abnormal stomach? Groedel's investigations in regard to this point concern especially gastrectasis and gastropotosis. He reproduces diagrams of the radiosopic picture of three cases of gastrectasis in elderly women. The especially characteristic point in these three diagrams is the constriction in about the middle of the descending portion of the stomach. This he looks upon as the characteristic feature of what he designates as "atonic gastrectasis." He explains its occurrence as follows: The normal stomach is approximately diffusely distended by the pressure of the food. The normal tone of the stomach wall prevents excessive dilatation at any one point. However, if the tone is lost, the entire pressure of the gastric contents is exerted on the lowermost portion, and all the contents collect at this point. The upper portion, toward the fundus, remains empty, except for the gases that collect in the extreme uppermost portion and give rise to the sensations of pressure and distention that these patients complain of. Thus the middle portion of the descending limb, in which there is neither gas nor food contents, simply collapses. (The physics of this does not sound convincing.) This, as has been mentioned, is the type that Groedel designates as atonic gastrectasis, and the one that is usually found in elderly persons with lax abdominal walls. He does not consider it a gastropotosis.

In young persons with gastrectasis Groedel found a somewhat different picture. Here the most striking feature is the remarkable length of the descending portion of the stomach as compared with the ascending portion. It differs from the form shown in the last group in the fact that there is no collapse in the middle of the descending limb, and that the fundus is relatively small and contains food material. Groedel believes

¹ Berl. klin. Woch., 1908, Nr. 15, p. 742.

that in this type the stomach wall has not lost its tone, but that the large deep-lying body of the organ, with its contents, exerts sufficient tension upon the upper portion to narrow greatly and lengthen it.

In regard to *gastroptosis*, Groedel takes a somewhat different view from that generally entertained. Since, according to his observations, the lowermost pole of the stomach may lie considerably lower than the umbilicus without signifying anything more than the forms of gastrectasis previously described, he thinks that this feature cannot be taken as an indication of a low position of the stomach. A dropping of the pylorus, however, furnishes a characteristic disease picture, and the one that comprises that group of symptoms usually expressed by the term *gastroptosis*. He consequently uses the term *pyloroptosis* for the majority of those cases in which the term *gastroptosis* has been employed. The diagnosis of *pyloroptosis* is accomplished with ease by means of the Röntgen rays. It is merely necessary to skiagraph the patient in different positions, for instance, standing and lying. In a patient with a normal stomach, when the patient is lying and when standing, it appears that the lower pole of the stomach has greatly descended, while the pylorus remains in practically the same position.

It is noted, moreover, that in a case of *pyloroptosis* the stomach, when the patient is lying, assumes something of a sandal form; whereas, in the normal person the same siphon form of the stomach is preserved when the patient is standing or lying. This Groedel thinks is due to the deficient fixation of the pylorus in *pyloroptosis*. Since *pyloroptosis* induces the collection of considerable amounts of food material in the lower pole of the stomach, gastrectasis, especially the form found in young persons, frequently associates itself with the *pyloroptosis*. Uncomplicated *pyloroptosis* Groedel has found almost only in young chlorotic girls with the general habitus enteroptoticus.

The Stomach in Nephritis. The earliest investigations on gastric digestion in patients the subject of nephritis were made by Biernacki. On the basis of the examination of a large number of nephritics, he concluded that nephritis in general causes a decrease in gastric secretion ranging from a slight reduction in hydrochloric acid to its total absence, and accompanied by proportionate reduction in the ferments. The more severe the nephritis the greater was the reduction in these elements. He found, moreover, that in general the amount of hydrochloric acid in the gastric contents and the amount of urine were proportionately decreased or increased. Gastric motility he found to be increased. Biernacki thinks the depressing action of retained metabolic products on the secreting glands to be responsible for the diminished gastric secretion. The hypermotility he accounted for in two ways: (1) By the irritant action of retained metabolic products on the motor nerves; and (2) by an attempt on the part of the body to compensate for the gastric catarrh by inducing the stomach to empty itself more readily

than normal, so as to prevent gastric fermentation. This increased motility is not infrequently seen in catarrhal gastritis unassociated with nephritis, and probably accounts for the absence of subjective symptoms in many patients suffering with gastric catarrh. Vierhuff was able to confirm the presence of catarrhal gastritis in nephritics by observations at autopsy.

Raulot-Lapointe, working on the same subject, came to the conclusion that in acute nephritis there is hypoacidity, and that as the nephritis improves, there is a gradual return of the gastric secretion to the normal. At times, as the nephritis was in the process of repair, he noted a hyperacidity, which he interpreted as an attempt of the body to rid itself of an excess of chlorine, which the kidneys, in their abnormal state, were unable to excrete. In chronic nephritis he found that when the parenchymatous element predominated there was hypochlorhydria and increased motility. When the interstitial element predominated, hyperchlorhydria was the rule. Raulot-Lapointe goes so far as to consider hyperchlorhydria an indication of a latent chronic interstitial nephritis, certainly a most extreme view.

A clinical study of these relationships between nephritis and gastric secretion was undertaken by Wolff and Martinelli.¹ Biernacki and Raulot-Lapointe do not mention placing their patients on a definite diet. Wolff and Martinelli placed their patients on a known diet, so that all variations in excretion and secretion could be accounted for. On the basis of their numerous observations, they conclude that, though a marked increase in the intake of sodium chloride has very little influence on the secretion of hydrochloric acid in the gastric contents of healthy persons, it is able to produce a vicarious hyperchlorhydria in nephritics. They agree with Biernacki, that hypochlorhydria exists, as a rule, in patients with nephritis, and they explain it on the same ground that Biernacki gives. The hyperchlorhydria found by Raulot-Lapointe in patients with chronic interstitial nephritis they consider a vicarious process, the result of the attempt on the part of the body to excrete the chlorine in excess of the amount that the kidneys are able to excrete. As chlorine retention is more common in chronic interstitial than in chronic parenchymatous nephritis, hyperchlorhydria is naturally more frequently found in the former condition.

Acute Dilatation of the Stomach, especially that form occurring subsequent to operation, continues to attract the attention of both clinicians and surgeons. Its etiology especially is a matter of discussion, experimentation, and conjecture. The view that is most generally held is that of a purely mechanical obstruction of the duodenum by the root of the mesentery. This hypothesis, first presented by Albrecht, is based on the assumption that when the empty intestines sink into the

¹ Archiv f. exper. Path. u. Pharmak., 1908, lviii, 450.

true pelvis, the root of the mesentery and the superior mesenteric artery are put upon such tension that they cause complete occlusion of the duodenum at the point where it passes under this mesenteric fold. Some observers, including Albrecht himself, hold that this sinking of the small intestines is not sufficient to produce a complete obstruction, but that it does produce obstruction enough to cause some overfilling and distention of the stomach, and that this prevents the sunken intestines from returning into the abdominal cavity. In other words, a vicious circle is established.

Another view, directly opposed to the foregoing, is that a functional disturbance of the stomach is the primary feature in the process; and that its distention, entirely independent of any constriction of the duodenum, forces the small intestines into the pelvis, and thus probably permits secondarily a more or less complete obstruction of the duodenum by the root of the mesentery. This latter view is held especially by Stieda and by v. Herff, who says: "The more I study the condition the more I am convinced that acute paralysis and paresis of the stomach are caused by injuries to its nervous apparatus; that these injuries are probably in the nature of trauma to the spinal column; that in a certain number of cases they occur secondary to an acute distention, in others as the result of the toxic action of chloroform, or possibly ether or toxins formed in the stomach. For a certain number of cases there seems to be no satisfactory explanation as yet."

Kelling thinks that a valve-like action of the cardia is the most important etiological factor in many cases. In others he thinks the mechanical explanation above offered is the correct one. With the hope of throwing some light upon the etiology of the condition, Braun and Seidel¹ undertook a series of observations and experiments.

Their first series of experiments were performed upon nineteen cadavers. By means of a small opening in the cardiac end of the stomach through which air could be introduced under pressure, they determined the degree of obstruction that could be effected by traction upon the small intestines and a loop of the mesentery. Throughout these experiments they were impressed with the fact that conditions in the cadaver are so different from those in the living that it is difficult to draw conclusions from the one that will hold good for the other.

Further experiments led them to believe that in the living there is a tonic contraction of the cardia; the closure of the cardia is increased in force by the diaphragmatic muscle surrounding the esophagus, by the angular insertion of the esophagus in the stomach, and by the lateral compression of the cardiac portion of the esophagus by the distended fundus.

The experiments on animals were performed in various ways. They

¹ *Mitth. a. d. Grenz. d. Med. u. Chir.*, 1907, xvii, p. 533.

first determined, by means of a gastric fistula, the effect of distention of the stomach with gas or air on the normal dog and on the narcotized dog. They found that the dogs that were not narcotized soon relieved themselves of the distention by means of eructation and vomiting; whereas in the narcotized dogs there was neither eructation nor vomiting to be observed, and the intragastric pressure was from two to three times as great as it was in the others. As soon as the dogs came out of their narcosis they relieved themselves by means of eructations and vomiting.

They next attempted to determine the influence that section of the vagi had upon the vomiting. On the basis of six experiments they were convinced that section of the vagi produced great inhibition or total abolition of vomiting. Section of the splanchnics, on the other hand, had only a slight inhibiting influence upon the act of vomiting. Section of the spinal cord between the last cervical and the sixth dorsal segments totally abolished vomiting and eructations. Section of the abdominal muscles in no way prevented the accomplishment of both these acts.

In reviewing the clinical facts, suggesting that a functional rather than a mechanical disturbance is the cause of the condition, they present a number of histories in which there were no indications suggestive of a mechanical obstruction, but in which the functional nature seemed especially evident. One of these cases they looked upon as unusually suggestive. Before operation the patient was subject to excessive vomiting. After the removal of the gallstones from which the patient suffered there was moderate vomiting until the third day, when it ceased. With its cessation, manifestations of acute dilatation of the stomach presented themselves, and with the progression of these symptoms there was continued absence of vomiting.

Another feature that Braun and Seidel think especially noteworthy is the fact itself that acute dilatation occurs so frequently in association with narcosis; in other words, with a form of intoxication. They think that narcosis and operative interference do not cause the dilatation itself, but that they cause merely the motor insufficiency, and consequently the disposition to dilatation. In order that the motor insufficiency lead to dilatation, it is necessary that in addition distention of the stomach with liquid, solid, or gases should occur. The authors think that peritonitis or inflammations of the abdominal viscera, in association with acute dilatation, act similarly by producing a disturbance of innervation of the stomach, a central or reflex disturbance of stomach tone and motility, as well as possibly of the act of vomiting. The most rational explanation of those cases occurring in the course of the severe infectious fevers or the wasting diseases, is that here also the stomach is suffering from a lack of functional energy through injury to the nervous system, or toxins depressing the muscularis directly, or inanition.

In regard to arteriomesenteric obstruction they do not deny that it is a frequent postmortem finding in acute dilatation of the stomach, but

look upon it as a secondary phenomenon and not as the cause of the dilatation. They conclude that (1) acute dilatation of the stomach is an expression of and a result of acute gastric motor insufficiency; (2) this acute motor insufficiency can affect a stomach previously healthy, as well as one the subject of a chronic or atrophic process; (3) it may occur as an independent disease or as a complication of other diseases; (4) the acute motor insufficiency of a previously healthy stomach is in the vast majority of cases of a purely functional and not a mechanical nature; (5) these functional disturbances are alterations of gastric innervation (central, peripheral, and reflex) and injuries to the gastric musculature; (6) all the surgical forms of acute dilatation may be explained on the basis of a disturbance of innervation, as well as most of those occurring in association with infectious diseases and with constitutional and other ailments; (7) a direct injury to the muscle fibers through mechanical, inflammatory, or toxic lesions is possible, although gross histological changes have thus far not been observed; (8) motor insufficiency and consequent dilatation occur as the result of a damming back of ingested materials, decomposition processes, or abnormally increased secretion; (9) acute motor insufficiency may occur in the absence of a predisposing factor, in a healthy stomach with intact innervation, as the result of profound dietetic errors or abnormal decomposition of ingested material; (10) acute dilatations occurring on top of chronic dilatation are usually induced by mechanical factors; (11) primary acute pyloric or duodenal occlusion occurs but seldom, and can be diagnosticated only when evident anatomical or mechanical lesions are present; (12) arteriomesenteric occlusion cannot be looked upon as the cause of acute dilatation, but only as a frequently unimportant result of the primary functional gastric dilatation; (13) the existence of a valve-like closure of the cardia has not been proved, and is not a necessary condition to acute dilatation of the stomach.

Thoma¹ also inclines to the belief that the dilatation is primary, and the arteriomesenteric occlusion of the duodenum a secondary manifestation. In discussing the therapeutics of the condition he emphasizes the use of gastric lavage early in the condition, continued until the wash water returns clear. Whenever it is at all possible, nourishment by mouth should be entirely omitted and the bodily strength maintained by nutrient enemata, saline enemata and infusions, subcutaneous oil injections, and stimulants. If in spite of the lavage the condition progresses and duodenal occlusion seems imminent, the patient should immediately be put in the Schnitzler position, on the abdomen or on the side—a measure that, simple as it is, to judge of the results from its employment, seems to be of the greatest value. Baümler recommends, in resistant cases, alternations of two hours on the abdomen and a

¹ Deut. med. Woch., 1908, Nr. 12, p. 501.

quarter of an hour in the knee-elbow position—a performance that in laparotomies would probably be accompanied with considerable difficulty. By means of these positions the small intestines would naturally be inclined to sink out of the true pelvis, and thus relieve the tension upon the root of the mesentery. These methods are usually followed by the most excellent results. Should they, however, fail, the performance of a laparotomy still remains. Gastro-enterostomy has been recommended, and has been employed several times with and several times without successful result. Kelling recommends the relief of the duodenal occlusion and tamponing of the true pelvis, in order to prevent a return of the small intestines into it. Most patients with acute dilatation, however, are too violently ill to undergo such a radical procedure.

The prognosis depends so much upon the early recognition of the condition and the early employment of the foregoing measures that attention to these facts, it is to be hoped, will succeed in reducing the mortality that in the past has been calculated as not less than 80 per cent.

Gastric Ulcer. As long as diseases cause complex pathological results, just so long will diagnosis be a question of judicial consideration of many things—and just so long will special signs that are nearly pathognomonic be described.

Bönniger¹ reports two methods of investigation that he thinks of great value in the diagnosis of gastric ulcer. One of them is the increasing of the pain of the ulcer by the introduction of acid into the stomach. His procedure is as follows: The stomach tube is passed in the morning before the patient has taken anything into the stomach. If no contents are obtained, 100 c.c. of water is poured in; after slight movements on the part of the patient, this is allowed to flow out. Through this procedure the pain of ulcer should not be increased. After the removal of this water, 100 to 200 c.c. of a decinormal hydrochloric acid solution is poured into the stomach through the tube. If ulcer is present sharp pains immediately appear, which can be dispelled by the administration of milk. If, however, there is no reaction the stomach is shaken and the patient is instructed to take various positions, so as to insure the fluid coming into contact with all parts of the gastric mucosa. If after these procedures there are no manifestations of pain, it is safe to say, according to Bönniger, that there is no ulcer present. A necessary condition to the application of this test is naturally an empty stomach. Moreover the object of it is primarily to increase the characteristic pain that the ulcer patient suffers; consequently, if the patient has not been suffering with any pain the test is useless.

The second means of investigation that Bönniger has found to be of assistance in the diagnosis is the determination, by means of the Röntgen

¹ Berl. klin. Woch., 1908, Nr. 8, p. 396.

rays, of how thoroughly a painful point corresponds with any particular area of the stomach. Naturally, the patient must be skiagraphed in the same position as that in which he is palpated. Bönninger considers also that this control of points of tenderness by means of the *x*-rays is of value in various other abdominal conditions.

This latter method may have a limited value. The former is palpably a clumsy and uncomfortable method, and it is difficult to see how it could help in distinguishing between ulcer, hyperesthesia, pylorospasm, and any other condition in which pain occurs as a consequence of hypersecretion. There is certainly no evident reason for recommending it, and unless there is good reason for doing so the stomach tube should not be used when ulcer is suspected. Diagnostic curiosity alone is not reason enough.

APPENDICITIS AND GASTRIC ULCER. Payr, in 1905, first called attention to the frequent association of appendicitis and erosions and ulcers of the stomach. The gastric lesions that he described were not the result of septic emboli, but of typical peptic ulcers occurring in the course of or subsequent to an attack of non-suppurative appendicitis, either acute or chronic. On the basis of his investigations of a large number of exhaustively studied cases in which the lesions in both appendix and stomach were treated by operation, Payr expresses himself as follows: "In a certain number of cases of appendicitis, usually of moderate severity, there appear, shortly after the first attack, various gastric symptoms closely resembling those of gastric ulcer. There is pain, occurring shortly after the taking of food; hyperacidity; vomiting, frequently bloody in character; and usually, later, phenomena suggestive of pyloric stenosis. These symptoms usually abate after a short time, but frequently repeat themselves after each new attack of appendicitis. In other cases it appears more as though the ulcer extended deep into the muscular layer of the stomach and caused chronic inflammatory changes in the serosa. In a large number of cases I have found band-like or scar-like adhesions in the neighborhood of the gastrocolic omentum or the anterior pyloric wall. In all these cases, perforation of the appendix could be absolutely excluded."

These gastric ulcers and erosions, according to Payr, are the result of emboli derived from the thrombosed veins of the omentum and the appendix. In his animal experiments he was able to show that emboli introduced into the omentum and mesentery under the strictest aseptic precautions were able to produce in the stomach and duodenum not only hemorrhagic erosions and infarcts, but actual ulcers with the characteristic pathological features of peptic ulcers.

Mahnert¹ undertook a clinical study of the frequency and significance

¹ *Mitth. a. d. Grenzgeb.*, 1908, xviii, p. 469.

of this relationship claimed by Payr to exist between the appendix and gastric ulcer. Most of the cases studied by Mahnert concerned patients with chronic appendicitis. He divides his cases into five groups. In the first group, consisting of ten cases, are those patients in whom the gastric lesions were observed at the time of the operation for the appendicitis, or in whom, after an appendectomy, operation for gastric ulcer had to be undertaken.

In the second group he includes those cases in which, at autopsy, a chronic appendicitis was found in association with a recent gastric ulcer. There were four such cases.

In the third group, consisting of seven cases, are included those patients with typical symptoms of gastric ulcer, who had previously suffered with an appendicitis that had been treated, but for which no operation was performed.

In the fourth group are those cases in which the patients presented themselves with the symptoms of gastric ulcer, and whose histories suggested their having previously had attacks of appendicitis, though the patients themselves had not been aware of these attacks having been such.

In the fifth group are those cases of gastric ulcer that, while devoid of symptoms of chronic appendicitis, presented the objective findings indicative of its existence.

On the basis of the statistics so gathered, Mahnert looks upon the frequent association of appendicitis with gastric ulcer as really striking. Among 36 undoubted cases of gastric ulcer, 23 (or 64 per cent.) presented equally undoubted evidences of a chronic appendicitis. He thinks that this frequency cannot permit a causal relationship between the two to be doubted. The cause he looks upon as that advanced by Payr, namely, embolism derived from aseptic thrombi in and about the appendix. Since most of his own observations concern chronic appendicitis, he believes that the above-mentioned facts present an indication for appendectomy in chronic appendicitis in which the local manifestations themselves may not always demand operative interference. On the same basis, he thinks that in all operations for chronic appendicitis the stomach should, if possible, be examined for the existence of an ulcer. These are interesting observations, but the number of cases is very small, and we need to draw conclusions in the matter very gradually.

SURGICAL AND MEDICAL TREATMENT OF GASTRIC ULCER. Great doubt still reigns as to the respective advantages of surgical and medical treatment of gastric ulcer. With the hope of throwing some light upon the question, Musser¹ has undertaken a statistical study of the results of treatment based upon the cases in the literature as well as many

¹ American Journal of the Medical Sciences, 1908.

hitherto unpublished cases. As he says: "The difficulties attendant upon a solution of the best methods for the treatment of gastric ulcer are great. The uncertainty of its clinical course renders statistics concerning therapy most confusing and often unreliable. It is often present without symptoms; its most active manifestations may be followed by a period of quiescence; it may recur at varying intervals; it may remain a mild disease, large groups being attended by minimum mortality; or it may be a grave affection, vicious to the extreme. There is or may be ever present that general nervous state or nutritional fault which precedes, attends, and, therefore, invites recurrence of ulcer." It may be added that an element contributing to the unreliability of statistics in gastric ulcer is the fact that many clinicians demand a much less strict adherence of the symptoms to those recognized as characterizing gastric ulcer than do others.

There is much variance of opinion as to what constitutes a cure in gastric ulcer. Statistics show that many observers consider the disease as cured, when after three or four weeks of treatment the symptoms are relieved or removed. No value can be attached to cases reported in such manner. It is well known that at varying intervals after an alleged cure, perforation or hemorrhage may occur. It would seem that a lapse of two years without symptoms, that an approach at least to normal chemical conditions, and a removal of all abnormal physical or mechanical states, are sufficient grounds to affirm that a cure has taken place in simple ulcer. To these may be added the absence of occult blood from the stools for a long period. Musser expresses the advantages and disadvantages of medical and surgical treatment as follows:

The Advantages of Medical Treatment. By the medical treatment the functional derangements, causal and secondary, are managed. It is conducted without doing violence to the body in any way, and if successful leaves the subject in as good condition as before.

The Dangers of Medical Treatment. A sense of false security is given as the ulcer may be dormant, and an accidental and fatal complication may arise when one is not prepared for it. The freedom from symptoms may flatter the patient that a cure has been established and induce carelessness in dietetics, hygiene, etc. Further, the healing of the ulcer, also possible under surgical treatment, may be attended with grave sequels of adhesions, contractions, or stenosis.

The Advantages of Surgical Treatment. By the surgical treatment, if indicated, the advantages of the medical treatment are secured. The operation is too often held to be the panacea, when success is really due to the after-cure. There is no reason why a patient who has undergone surgical treatment should not have an after-treatment like that which is given to cure the tendency to ulcer. The advantages depend upon the nature of the operation and the ability to deal with the complications. If the operation of excision is resorted to the symptoms and

accidents are prevented, providing, of course, there is only one ulcer. Gastro-enterostomy, now in vogue, is a procedure which, while it relieves the many symptoms, does not of itself warrant the belief that a cure is established. It is not proved that the ulcer has healed. Both perforation and hemorrhage occur after gastro-enterostomy. It is not known that relapse or recurrence is less frequent than in ulcers treated medically. The splendid statistics of Robson and of Mayo in their end results compare favorably with, but are not better than, similar statistics of men who have treated similar groups of cases medically. The time element in the surgical cases is the unsettled factor. If the ulcer is excised, a dangerous and often not practical procedure we are told, or destroyed by perforation, the only subsequent risk comes from persistence of the organic cause or the presence of two or more ulcers. In the second period of ulceration, when complications have arisen, the advantages are entirely in favor of surgery.

"The Dangers of Surgical Treatment. (1) The same as in the medical treatment, unless excision of the ulcer, if solitary, is resorted to; (2) operative death; (3) death from complications; (4) death or ill health from defects in metabolism; (5) the effect of the operation. The patient on whom an operation has been performed has the disadvantage of a psychic insult, the influence of which is not trifling, and of being in possession of new physical and physiological conditions, the nature of which time alone can tell. It must be admitted that a patient who has undergone a grave surgical operation is not in as good condition to have that indefinable something, which may be termed neurosis, cured as he who has not been submitted to such an insult."

It is true that, with the perfection of technique and with the increased experience of surgeons, the operative mortality has greatly decreased. The average operative mortality has decreased from 20 per cent. to 10 per cent., and is but from 1.5 to 2 per cent. for individual operators.

The variations in the frequency of gastric ulcer in various countries, as well as in various cities, is noteworthy. Statistics of the frequency of gastric ulcer based on autopsies show variations of from 0.13 per cent. to 5 per cent. In America, Boston has the highest percentage, 1.28; and Denver the lowest, 0.12. In Breslau and in Zurich, 0.66 per cent. of the cases coming to autopsy were found to have gastric ulcer; in London, 0.78 per cent.; in Berlin, 1.33 per cent.; in Edinburgh, 2.2 per cent.

The frequency of gastric ulcer based on clinical observation shows a variation of from 0.0022 per cent. to 2 per cent. It should be noted, in regard to such a striking variation, that the percentage of cases of gastric ulcer varies greatly with the class of patients and the locality, as well as with the views of individual observers in regard to the symptoms necessary to a diagnosis of gastric ulcer. After a review of all the

statistical features concerned in the study of a large number of cases, Musser comes to the following conclusions:

Gastric ulcer is a medical disease. Gastric ulcer with complications and sequels is sometimes a surgical disease; if perforation occurs, it becomes a surgical affection at once; if hemorrhage occurs acutely, it is rarely a surgical affection; if repeated and chronic, it is a surgical affection.

If the ulcer is productive of perversion of secretory function alone, it remains a medical affection. Inasmuch as hyperchlorhydria is, in part, a neurosis, the secretory function can be balanced chiefly by medical, dietetic, and hygienic measures. Even if pyloric spasm attends the hypersecretion and hyperacidity, it does not necessarily take the case beyond medical care. It is wrong to submit such patients to operation, unless motor disturbances become prominent.

If the symptoms and physical signs of retention from obstruction, dilatation, hour-glass contraction, or adhesions supervene and persist, the case is surgical.

If the symptoms of gastric ulcer become continuous in spite of medical treatment and incapacitate or threaten life, and if hemorrhage recurs and secondary anemia arises, it is a surgical disease. Such cases, however, are always attended with organic sequels.

The extraordinary frequency of chronic gastric ulcer with sequels requiring operation is due to neglect of the treatment of an ulcer in its incipency. Statistics show that most patients are operated on between the thirtieth and fortieth year, and have an ulcer history of five or ten years' duration.

What, as a medical attendant, should one do with a case of gastric ulcer? From personal experience and a study of recorded cases, Musser considers that if it is a simple uncomplicated ulcer we should employ rest, at first absolute, and later modified, a suitable diet, and the drugs indicated, for at least four months. If attended with an organic complication, as pyloric obstruction from thickening or from adhesions, or by dilatation, if extreme, or by hour-glass contractions, surgical measures are in order. If perforation occurs there should be no delay in operating.

If hemorrhage occurs, operation is rarely necessary; and if acute, not unless the peril of hemorrhage outweighs that of operation—a nice estimation of values. If hemorrhage is persistent and gives rise to anemia, operation is indicated. Under any circumstances, and until cure is established, keep the patient in touch with a surgeon. The physician should never assume the attitude of a distinguished physician who congratulated himself that he did not ask the surgeon to see a case because it had features like those of pancreatitis, a suspicion borne out by the autopsy, which showed such a lesion. It should be the duty of a physician to associate with himself a surgeon, to the end that accidents may be taken care of at once and organic sequels relieved.

The final and very serious duty is the selection of the surgeon. One who has good technical ability and has had considerable experience in gastric surgery should be selected. The operation, even of gastro-enterostomy, is not trivial, and requires the best service at command.

After the surgical procedures, if necessary, are carried out the patient must be treated medically. Medical treatment must be continued over a period of four months at least; hygienic and dietetic treatment over a period of years.

A patient who has had gastric ulcer should, for all time, observe the hygienic and dietetic rules which keep digestion to an approximately normal state, which prevent anemia, and which, above all, so conserve the nervous system as to prevent neurosis.

LENHARTZ TREATMENT. The Lenhartz treatment of gastric ulcer has apparently received but little consideration, especially in this country, and, judging from reports, has been but very infrequently employed. Lambert¹ had the opportunity of treating five cases of ulcer and three cases of hyperchlorhydria, probably unassociated with ulcer, by this method. He recognizes that definite conclusions cannot be based upon such a small number of cases; but the results of the treatment are not without interest. The use of this form of treatment was prompted by the events that occurred in two cases that were being treated by the more generally accepted methods of limited diet, preceded by rectal feeding.

The first patient was a well-developed man who had suffered with attacks of vomiting and pain in the stomach for six months. For almost four months he had been on a diet of raw eggs, stale bread, and milk. He had lost thirteen pounds in weight. He was put on a routine ulcer cure and fed with nutrient enemas of peptonized milk and eggs. This was continued with gastric starvation, except for water, for a period of thirteen days, when gastric feeding with peptonized milk was begun; and by the twentieth day of treatment the patient was taking eight ounces of milk every four hours. On this day he developed a purpuric rash on both legs, with pains and with spongy, bleeding gums. It became evident that the ulcer cure had induced a typical attack of scurvy.

The second case was that of a woman, aged thirty-two years, who, after seven days of rectal feeding and gastric starvation, and a subsequent seven-day period of limited gastric feeding with peptonized milk, continued to have occult blood in the stools and a severe degree of anemia. It was a problem whether to continue medical treatment or to resort to surgical interference. Before adopting the latter procedure it was decided to try the Lenhartz cure:

The Lenhartz treatment attempts, first, to furnish nourishment and improve the patient's general condition; second, to prevent distention

¹ American Journal of the Medical Sciences, 1908, No. 1, cxxxv, 18.

of the stomach by a careful limitation of the size of each food portion and of the fluids taken, and by the use of ice applications externally; third, to prevent the action of the excessive hydrochloric acid content on the ulcer's surface by combining it with food albumin. Food is administered in small quantities at one-hour intervals. Slow mastication and slow eating are insisted upon, and these are accomplished by feeding the patient with teaspoonful amounts to each mouthful, and by never allowing him to feed himself during the first two weeks of the cure. A three to four weeks' rest in bed is insisted upon in each case. An ice-bag is usually applied to the epigastrium, and bismuth subnitrate is administered internally for hemorrhage. The preparation of the foods used during the first two weeks of the treatment is as follows:

The raw eggs are beaten up whole and iced. Both the milk and the egg are placed in covered glass tumblers, surrounded with cracked ice, and kept at the bedside. The feeding spoon is also kept iced. The eggs and milk are administered in alternate feedings. Granulated sugar is added to the eggs on the third day. The raw, scraped beef, boiled rice, and zwiebach are prepared in the usual manner.

The routine of administration is as follows:

Day.	Eggs.	Milk.	Sugar.	Scraped beef.
1.	2 drams each dose. Total, 2 eggs.	4 drams each dose. Total, 6 oz.		
2.	3 drams per dose. Total, 3 eggs.	6 drams per dose. Total, 10 oz.		
3.	$\frac{1}{2}$ oz. per dose. Total, 4 eggs.	1 oz. per dose. Total, 13 oz.	20 grams added to eggs.	
4.	5 drams per dose. Total, 5 eggs.	$1\frac{1}{2}$ oz. per dose. Total, 1 pint.	Same.	
5.	6 drams per dose. Total, 6 eggs.	14 drams per dose. Total, 19 oz.	30 grams.	
6.	7 drams per dose. Total, 7 eggs.	2 oz. per dose. Total, 22 oz.	40 grams.	36 grams in 3 doses.
7.	4 drams per dose. Total, 4 eggs. Also 1 soft-boiled egg every 4 hrs. Total, 4 eggs.	2 oz. per dose. Total, 25 oz.	40 grams.	70 grams with boiled rice; 100 grams in 3 doses.
8.	Same as above.	$2\frac{1}{2}$ oz. per dose Total, 28 oz.	Same.	Same.
9.	Same as above.	3 oz. per dose. Total, 1 quart.	Same.	Beef, same; rice, 200 grams; zwiebach, 40 grams in 2 portions.
10.	Same as above.	Same.	Same.	Same.

Add cooked chopped chicken, 50 grams, or ham, 50 grams, and butter, 20 grams.

11-14. Interval of feeding made two hours. Milk given in 6-oz. doses, with $\frac{1}{2}$ oz. of raw egg. Butter increased to 40 grams, and chicken or ham given as above.

The five cases of gastric ulcer were all cured, one of them after a distinct failure with the older treatment. Blood disappeared from the stools, in one case on the eighth day; in another on the twelfth; in another on the thirteenth; in another on the twenty-first; and in the fifth case no blood had been found. Of the three cases with hyperchlorhydria, but in all probability without ulcer, two were cured, the uncured case being one of benign stenosis.

Ewald,¹ in a very thorough presentation of his treatment of gastric ulcer, does not express much enthusiasm over the value of the Lenhartz treatment. Though he has not used it extensively, a comparison of the percentages of hemorrhage in the cases he has treated by the older established methods, with the percentage of hemorrhage of the cases treated by the Lenhartz method, convinces him that the older method is the more valuable. He had but 4.8 per cent. of hemorrhage after the thorough institution of treatment by limited feeding; whereas, Lenhartz, in 201 cases, had 6.4 per cent. of hemorrhage. Ewald's treatment, as presented in his article, contains no elements that can be looked upon as novelties, but is a conservative, rational combination of well-tried methods. Naturally the opinion of one of such vast experience as Ewald must command the attention of everyone.

Benign Stenosis of the Pylorus. Lambert and Foster² report eleven cases of benign stenosis of the pylorus that came to operation. After discussing the symptomatology and the medical treatment of these cases, they discuss the relative advantages and disadvantages of *pyloroplasty* and *gastro-enterostomy*. Pyloroplasty does not give so rapid relief as does gastro-enterostomy. After pyloroplasty the patients require careful watching and study to see that they do not return too rapidly to a normal diet and a normal method of living. It often takes several months to a year before such patients secure the full extent of benefit that follows this surgical procedure. Gastro-enterostomy, on the other hand, sometimes fails to give relief by causing the condition known as vicious circle, which can be cured only by means of a second operation. There is always danger after this operation of a subsequent peptic ulcer in the small intestine below the anastomosis, even though it be an infrequent occurrence. Lastly, the disarrangement of the coils of intestine resulting from this operation may be the cause of a subsequent intestinal obstruction. The writers confess to a strong prejudice in favor of a pyloric operation, because of its undoubted approach to a restoration of a condition more like the normal.

Lambert and Foster emphasize the error of delaying too long in adopting surgical measures in cases of benign stenosis of the pylorus. Medical treatment should be tried first; but if after a reasonable period there are no decided signs of betterment, operation should be

¹ Deut. med. Woch., 1908, Nr. 9, p. 361.

² American Journal of the Medical Sciences, 1907, cxxxiv, 335.

advocated. If delayed too long, dilatation and other structural changes in the stomach lessen the chances of a permanent cure. They furthermore lay emphasis upon the fact that the mere correction of the mechanical error does not suffice for the cure of these patients. After the patient has recovered from the surgical procedure, methods of treatment should be instituted to overcome the muscular atony of the stomach wall, to control the hypersecretion of hydrochloric acid, or to excite the mucous membrane to resume its normal secretory activity.

The result of treatment in the eleven cases forming the basis of the authors' paper may be tabulated as follows:

	Operation.	Result.
Fibrous stenosis	{ Pyloroplasty.	{ Two cured.
	{ Gastro-enterostomy.	{ One partially cured.
Fibrous bands	{ Relief of obstruction.	{ One unknown.
	{ Gastro-enterostomy.	{ One cured.
Obstruction from glands . .	Gastro-enterostomy.	{ One partially cured.
Myoma of pylorus	Gastro-enterostomy.	{ One cured.
		{ One died (peritonitis)
		{ One unknown.
		{ One cured.
		{ Cured.

Carcinoma of the Stomach. In 1903 Schmidt called attention to the occurrence of *lactic acid bacilli* in the stools of patients suffering from carcinoma of the stomach, and emphasized the importance of this observation from the standpoint of diagnosis in those cases in which a test meal is contra-indicated. Sandberg¹ undertook an investigation of the same nature. In doing so he originated a method for culturing the organisms, which, on account of its apparent reliability and simplicity, seems to possess considerable value. In some previous experiments he had observed that lactic acid bacilli are much more resistant to gastric juice containing lactic acid than are other organisms, especially the *Bacillus coli communis*. His method consists in sterilizing with chloroform the gastric contents of patients suffering from gastric carcinoma. One must first be sure that these gastric contents contain lactic acid; 45 c.c. of this fluid are then inoculated with two platinum loops of the feces to be examined for the presence of lactic acid bacilli. These are well mixed and allowed to remain at room temperature. After twenty-four hours a grape-sugar agar plate is inoculated from this mixture of feces and gastric juice; after thirty-six hours, a second; and after forty-eight hours, a third. One of these agar plates, usually either the one inoculated after thirty-six or the one inoculated after forty-eight hours, will be found to contain a pure growth of lactic acid bacilli. Sandberg believes that lactic acid bacilli are present in the feces only when they are present in the stomach; and, consequently, when found

¹ Münch. med. Woch., 1908, Nr. 22, p. 1171.

they are almost diagnostic of carcinoma of the stomach. A negative finding, however, is of a decidedly less value than is a positive finding.

HEMOLYTIC SUBSTANCES IN CARCINOMA. The severe degree of anemia and the rapid loss of strength frequently seen in patients with carcinoma of the stomach, in which the tumor is so small as to be out of all proportion to the severity of the anemia, and loss of strength have long led to the view that these tumors give rise to some intoxication that affects the entire body, and that the symptoms are not purely the result of the local action of the carcinoma. Proceeding upon this assumption, Graefe and Röhmer¹ examined the gastric contents of patients suffering with various sorts of gastric disorders for the presence of hemolytic substances. They found substances possessing hemolytic properties in all of the thirty-six cases of carcinoma of the stomach studied. In numerous other cases, including those in which gastric symptoms were present, as well as many patients who were normal as far as their gastric condition was concerned, their results were almost negative, though in a few of these cases they did get a positive reaction.

This hemolytic substance is soluble in alcohol and ether, is thermostabile, and is capable, in the smallest quantities, of inducing hemolysis of human and animal blood. It is in all probability a lipid, the active principle of which is probably oleic acid derived from the carcinomatous, ulcerated stomach wall. This work is of course of questionable value at present, but it is suggestive especially because of similar work in relation to pernicious forms of anemia.

Chlorosis and Gastric Disorders. The relation, or rather lack of relation, between gastric disease and chlorosis has long been a subject of discussion, and, while now pretty well settled, has been studied again by Liwischitz,² who has undertaken an investigation of the function and position of the stomach in chlorosis.

In regard to gastric acidity he concludes that there is a definite tendency to hypochlorhydria in patients suffering with chlorosis. In many cases the secretory relations are normal throughout; hyperchlorhydria is found in only a very small percentage of the cases. He believes that the gastric symptoms of which patients suffering with chlorosis complain, can no wise be referred to alterations in the gastric acidity. This is almost certainly, however, sometimes true and sometimes not. As a rule, the symptoms are simply a part of the general disease. Sometimes chlorotics get actual gastric disorders just as other people do, and indeed their habits of diet and the like make them rather especially subject to them. In regard to the motor activities of the stomach, his findings were more striking. In a vast majority of the patients with chlorosis he found a decided decrease in gastric motility.

¹ Deut. Arch. f. klin. Med., 1908, xciii, 161.

² Arch. f. Verdauungskrankh., 1908, Band xiv, Heft 1, p. 47:

He found, moreover, that the more severe the chlorosis the more intense was the decrease in the motor powers.

In studying the relation of *gastroptosis* to chlorosis, his observations indicate that though the two are not infrequently associated, they are by no means constantly found together. His conclusions on this point speak decidedly against the view that the entire clinical picture of chlorosis can be explained on the basis of gastroptosis, a view I would say that is at present held by scarcely anyone, since it is long disproved.

Chorea and Gastric Disease. Ewald and Witte¹ present, as a case of unusual interest, one in which a gastric disease was complicated by an acute chorea. The patient was a woman, aged twenty years, who, a few months before presenting herself to them, began to suffer with symptoms suggestive of ulcer of the stomach. In the meantime she was said to have lost seventy pounds. Three days before admission to the hospital symptoms of chorea presented themselves: first in the left arm, later in the right arm, then in the face and legs, and finally in the entire body.

When she came under their observation she was found to be an extremely emaciated, delicately formed woman, with the typical manifestations of a severe chorea. Aside from the features incident to the pyloric stenosis, a severe degree of anemia and the choreic manifestations already mentioned, the patient presented no abnormalities. It was especially noted that there were no evidences of psychical or nervous disturbance excepting chorea. Two days later 250 c.c. of yellowish-brown, fetid, almost fecal-like stomach contents were removed by means of the tube. Whereas, up to the time of this lavage the choreiform movements had been extremely violent; shortly afterward they almost entirely ceased. About this time herpes labialis appeared, and acetone was noted in the urine. Treatment directed toward the relief of the gastric retention was accompanied by a disappearance of the choreiform movements, as well as many of the purely gastric phenomena. A diagnosis of pyloric stenosis as the result of ulcer was made, and this diagnosis proved to be correct at operation.

It is a well-known fact that nervous manifestations, especially tetany, at times accompany gastrectasis; but Ewald and Witte have never before noted a chorea on the basis of a gastric disorder. That the condition was a true chorea they have no doubt, and the description of the case conforms entirely to the typical picture of chorea. Whether, however, the chorea occurred as an accidental accompaniment of the gastric disorder, or as the result of it, is a question open to some discussion. The patient was just the type of individual subject to chorea—emaciated, slender, anemic—but other immediate factors are essential to the development of a chorea, and Ewald and Witte think that these were

¹ Berl. klin. Woch., 1908, Nr. 2, p. 45.

furnished in the toxemia resulting from the absorption from the decomposing gastric contents. The facts that they think speak for this view are the extreme degree of fermentation and putrefaction that was evident in the stomach contents, the marked decrease in the chorea after lavage with salicylic acid and borax, the occurrence of herpes labialis, and the temporary appearance of a trace of albumin and acetone in the urine. The authors think that this case lends some support to the view that chorea may be a manifestation of the absorption of toxins from the gastro-intestinal tract. As to whether the same substances are able in one case to produce a chorea and in the other a tetany, is a question that only future observations can determine.

Phlegmonous Gastritis. It is a fact of considerable clinical interest, and possibly of some etiological significance, that within the past year two cases of phlegmonous gastritis in association with pregnancy have been reported. According to Robertson,¹ who reports two cases of phlegmonous gastritis occurring in males, but 91 cases of this condition have been reported. Of 80 of these cases in which the sex is mentioned, 11 occurred in females. In view of this comparative rarity of the condition in females, it is noteworthy that 2 cases in association with pregnancy should have been reported during the last year.

The first case was that described by Kermauner.² The patient was a woman, aged thirty-nine years, who had complained of vague gastric symptoms for some years. She was admitted to the hospital with symptoms suggestive of peritonitis. Two weeks later, shortly after giving birth to an almost full-term dead fetus, she died. At autopsy a phlegmonous gastritis, limited to the lesser curvature of the stomach, was found, in addition to a secondary purulent peritonitis. The second case was one reported by Bovée,³ and constitutes, as the author says, probably the only successful laparotomy performed for the condition. The patient was thirty-six years of age, and was about six months pregnant when symptoms of a violent inflammatory condition in the upper abdomen presented themselves. At operation a mass the size of a man's fist was found near the pyloric end of the greater curvature of the stomach. On incision it was found to contain pus, which was drained; and the patient, after having aborted, made a successful recovery.

The Gastric Mucus. Kaufmann⁴ describes a condition characterized by a lack of gastric mucus, which he designates as *amylorrhoea gastrica*. He says that he has for some years routinely investigated the gastric contents removed after test meals for the amount of mucus present, and has thus become convinced that a decrease from the normal amount

¹ Journal of the American Medical Association, 1907, No. 26, xlix, 2143.

² Mitth. a. d. Grenz. d. Med. u. Chir., 1907, xvii, 627.

³ American Journal of the Medical Sciences, 1908, cxxxv, 662.

⁴ Ibid., No. 2, cxxxv, 207.

constitutes a pathological condition. The mucus is recognized by both its macroscopic and its microscopic qualities. Macroscopically it may be recognized by its coherency and its tendency to hold together the solid particles into a more or less compact mass. Microscopically he is able to recognize the presence of mucus very readily by the myelin drops contained in it. The microscopic picture may be made more characteristic by treating the specimen with a dilute lugol solution which stains the starch blue and the yeast yellow, but does not stain the myelin drops. Since the lugol solution does not mix with the mucus, the starch globules that are contained in it are not stained. Only those lying about the margins show the typical color reaction. If, however, mucus is absent, all the starch granules present are clearly seen as well-defined bluish bodies.

According to Kaufmann's observations, alterations in the amount of mucus do not go hand-in-hand with alterations in the amount of acid. In some cases of achylia gastrica he finds increased quantities of mucus; in others no mucus at all. Cases of hyperacidity, though as a rule accompanied by a lack of mucus, at times show an increased amount. Since the mucus is the protective agent of the gastric mucosa, when it is absent the mucosa is naturally subjected to influences that are normally not able to affect it. In cases in which there is no acidity, or in which the acidity is very low, it is of little importance whether the mucosa is covered with a thick or a thin layer of mucus. When, however, the acidity is high and there is a deficient amount of mucus, the mucosa is exposed to the irritant action of this hyperacidity. Kaufmann calls attention to the fact that many cases manifesting the symptoms of hyperacidity do not present the chemical characteristics of this condition; and, on the other hand, that many cases with high hydrochloric acid values present no symptoms. He thinks it not improbable that these relations are dependent upon variations in the amount of gastric mucus, and not entirely, as is usually considered, upon a neurosis.

He emphasizes the almost immediate relief of the hyperacidity symptoms upon the application by lavage of solutions of silver nitrate. Since silver nitrate is a powerful stimulant to the mucous glands, he believes it not improbable that this relief is due to the silver nitrate inciting the glands to the production of mucus.

He thinks that even in the production of gastric ulcer deficient amounts of mucus may play an important role. Deprived of its normal protection the mucosa is exposed to various mechanical, chemical, and thermal insults, which may sufficiently affect the surface to permit the ingress of other agents that will eventually succeed in producing ulcer. He thinks that even the value of silver nitrate in the treatment of ulcer is a manifestation of the effect of gastric mucus upon lesions of the mucosa. These observations are suggestive, and the matter should be looked into further. We are too prone to think that a generous secre-

tion of mucus is simply a disadvantageous result of disease of mucous membranes. It is quite reasonable to consider that it is one of Nature's methods of seeking to give relief.

THE INTESTINES.

Tests for Occult Blood. The examination for occult blood in the feces continues to be recognized as a valuable addition to our diagnostic equipment. There is, however, some doubt as to the value of the respective methods that have been employed for its recognition. Some of the tests are not delicate enough; others are so delicate as to give a positive reaction when meat has been eaten some days previous to the examination. Goodman¹ has investigated the relative value of the guaiac, aloin, and benzidin tests, paying especial attention to the reliability and accuracy of the latter. The method he recommends for the application of the benzidin test is as follows: A small portion of the feces solution, obtained by grinding up the feces with water, is poured into a test-tube and boiled. While this is cooling a concentrated solution of benzidin is made by dissolving as much benzidin as is contained in a very small spoon spatula in about 3 to 5 c.c. of glacial acetic acid. A few drops (1 c.c.) are poured into a test tube, and about 3 to 10 drops of the boiled feces solution, further diluted with equal parts of water, are added, and the two shaken. To this are now added 1 to 3 c.c. hydrogen peroxide (3 per cent.) and shaken, when, in the presence of blood, a deep, dirty-green or a beautiful deep-blue color appears, changing, in the course of time, to a peculiar dusty-violet color. Only the green or blue color is to be considered positive. Goodman emphasizes the importance of using small quantities of the reagent.

Goodman agrees with Schlesinger and Holst, that the benzidin test is simpler than any other method; that it is more delicate than the aloin and guaiac tests; that by boiling, all disturbing factors, such as ferments, are destroyed; and that the test is made more sure by the control of the reagents.

In studying a large series of feces with the aloin, guaiac, and benzidin tests, Goodman was convinced that the benzidin method is the most delicate of the three. This delicacy, however, is so great as to detract somewhat from the value of the test, for the reasons that have already been mentioned. Goodman consequently recognizes the absence of a positive reaction as being of most value. In other words, if a specimen is negative to the benzidin test, one may with all assurance say that occult blood is not present. A positive reaction, however, should be controlled by either the guaiac or the aloin test, or by both. The test is applicable to gastric contents and urine, as well as to feces.

¹ American Journal of the Medical Sciences, 1907, cxxxiv, 506

Causation of Chronic Constipation. Schmidt, Strasburger, and Lohrlich, in constructing their theory of the cause of chronic habitual constipation, presuppose a too thorough digestion and absorption of foodstuffs as being one of the primary factors in its production. Lohrlich, investigating the stools of persons suffering with habitual constipation, found both the solids and the water to be much less than in the stools of normal persons. Pletnew¹ undertook a series of investigations on persons suffering with chronic constipation, and obtained approximately the same results as did Lohrlich. As a result of his experiments, however, Pletnew was able to find nothing to indicate that the cause of the constipation was a too thorough digestion and absorption of ingested material. From all he could observe, the condition might just as well be the result of deficient secretion in the gastro-intestinal tract; and he looks upon this as the more rational explanation.

One of the most startling therapeutic measures presented within the past year is Lane's operative treatment of chronic constipation. He² has apparently made the mistake of looking upon every abdominal condition associated with constipation as the result of the constipation; whereas, in all probability, a vast majority of the conditions that he describes are but accidentally associated with it. It is possible that in rare instances in some of the advanced secondary changes in the large bowel which result from long-continued constipation and the abuse of laxatives, there is so much structural change as to make surgical intervention the only means capable of satisfactorily combating the existing conditions. However, in this case one is not treating the chronic constipation, but a hypertrophied and probably ulcerated and greatly inflamed intestine. Without doubt the vast majority of physicians, as well as laymen, would hesitate long before recommending or subjecting themselves to a resection of the entire colon for chronic constipation.

Palpation of the Appendix. The question whether the normal appendix is palpable or not has brought forth the most conflicting answers from clinicians as well as surgeons interested in this organ. On account of the importance of the question, Jaworski and Lapinski³ undertook the palpation of the organ in 800 persons. Their investigations were performed exclusively on men, in order to exclude the danger of being confused by the uterine adnexa. No men were examined for this series whose histories were at all suggestive of a previous appendicular disease. The conditions necessary for the appendix to be palpated are as follows:

1. The appendix must lie horizontally on the aponeurosis of the iliopsoas muscle, and must run transversely, diagonally, or vertically. If it runs inward and upward it will be so covered by the cecum as to

¹ Zeitsch. f. experim. Path. u. Therap., 1908, Band v, Heft 1, p. 186.

² Berl. klin. Woch., 1908, Nr. 12, p. 599.

³ Wien. klin. Woch., 1908, Nr. 6, p. 182.

make it impossible of palpation. According to the statistics of Sudsuki, and of Lafargue, the appendix runs in one of these directions, permitting of palpation in from 68 to 84 per cent. of all cases.

2. The abdominal wall must not be too thick, and it must not be too rigid.

3. The iliopsoas muscle must be put on tension, so as to form a firm foundation on which the appendix can be palpated. This is an absolutely necessary condition. If it is impossible to feel this tense iliopsoas, it is impossible to palpate the appendix. To put it on the stretch the patient must hold his extended right leg elevated about eighteen inches.

4. The position of the palpating hand is of the greatest importance in the examination. Standing to the right of the patient the examiner must place the outer border of the right index finger at right angles to the course of the iliopsoas muscle, deep in the ileocecal region. Pressure is exerted until the sharp border of the iliopsoas is felt, when the finger is moved up and down along the course of the iliopsoas, when a movable rather firm, cylinder-like cord will be felt, the consistency of which seems to alter with the duration of the pressure.

By this means Jaworski and Lapinski believe they were able to palpate the appendix distinctly in 51.5 per cent. of the 800 persons they examined. In 94.6 per cent. of these cases the course of the appendix was at right angles to the long axis of the iliopsoas.

TRAUMA AND APPENDICITIS. Trauma has not been recognized as playing much of an etiological role in the production of appendicitis. Ebner¹ reports a case of appendicitis developing in a man immediately after a blow in the right iliac fossa. Reviewing the literature and the opinions held by different observers, he sums up the relation of trauma to appendicitis as follows: (1) Trauma is able to induce an attack of appendicitis in an already diseased appendix; (2) trauma is equally able to induce an appendicitis in an unaltered appendix that contains a fecal concretion; (3) trauma is in all probability not able to induce appendicitis in an unaltered appendix containing no concretions.

CASTOR OIL IN THE DIAGNOSIS OF APPENDICITIS. Sonnenburg² created quite a discussion among the German surgeons by his claim that the administration of castor oil is of great assistance in the early diagnosis of appendicitis. He administered routinely castor oil to all patients with appendicitis in whom the symptoms indicated the existence of a simple catarrhal appendicitis. This condition he considers to be characterized by a pulse of approximately 92, temperature of approximately 37.5° C. (97.7° F.), and a leukocytosis of approximately 15,000. If in this type of case symptoms did not abate within twenty-four hours after the administration of the castor oil, operation was undertaken.

¹ Berl. klin. Woch., 1908, Nr. 9, p. 445.

² Therap. d. Gegenwart, 1908, Band x, Heft 2, p. 49.

He thus looked upon the results of the administration of the oil as a diagnostic aid to the determination of the character and degree of the inflammation.

His opinion did not receive much support. Körte, Rotter, and others cited cases in which the administration of the oil as recommended by Sonnenburg had directly induced perforation and subsequent peritonitis. They claimed, furthermore, that the majority of cases of simple catarrhal appendicitis that improved after the administration of the oil would have improved without this measure. It was the consensus of opinion that the administration of castor oil is of neither of diagnostic nor therapeutic assistance.

CARCINOMA OF THE APPENDIX. The attention that the appendix has claimed for itself, and the frequency of operation for appendicitis, have revealed the fact that carcinoma of the appendix is by no means an infrequent condition. McWilliams¹ has collected ninety undoubted cases of carcinoma of the appendix, including the three that he reports. A compilation of the statistics from these cases reveals some very interesting facts. Eighty-three per cent. exhibited the symptoms of appendicitis in some form. Sixty-three and one-half per cent. had had symptoms of chronic appendicitis in some form for varying periods of time. In more than 28 per cent., symptoms had existed for over a year. As McWilliams remarks, this lends weight to the hypothesis that chronic inflammatory changes are the cause of the malignancy. It was, moreover, found that of twenty-three cancerous appendices removed for chronic symptoms 70 per cent. showed changes characteristic of chronic inflammation in addition to the malignancy. This of course does not prove that the cancer was the result of the chronic inflammation; it may have been the cause of it.

In compiling the records of a number of observers, McWilliams found 0.4 per cent. of the appendices removed at operation to be carcinomatous. This figure is somewhat smaller than is generally held. The average age McWilliams finds to be 27.7 years, which is somewhat younger than the average for carcinoma of other portions of the gastro-intestinal tract. As to sex the condition occurred in 43 per cent. of males, as contrasted with 57 per cent. of females. This is quite different from the frequency of simple inflammations of the appendix in the two sexes. Deaver found in 3000 cases of appendicitis, that 62 per cent. occurred in men and 38 per cent. in women. It is interesting that of ninety cases of carcinoma, only 8 or 9 per cent. showed enlargement of the neighboring lymph nodes. It must be inferred from this that cancers of the appendix involve the lymphatics very late.

An investigation into the location of the tumor reveals the fact that in 59 per cent. of the cases it was situated at or near the tip of the organ,

¹ American Journal of the Medical Sciences, 1908, No. 6, cxxxv, 832.

and in 76 per cent. was located at or distal to the middle. These facts are noteworthy, showing, as they do, that primary carcinoma of the appendix develops most frequently in the regions where strictures and chronic inflammations most commonly occur. It is a fact of considerable prognostic significance that of seventy-nine patients from whom the appendix was removed for carcinoma, but one is definitely known to have suffered recurrence. This is a clinical fact thoroughly in harmony with the pathological fact mentioned above, that lymph-node metastases were seldom found.

In conclusion, McWilliams remarks that the symptoms of appendicular cancer are not sufficiently characteristic to permit of a diagnosis without operation; and, furthermore, that since all appendices the seat of carcinoma are not enlarged, every appendix removed at operation should be subjected to a microscopic examination.

A. O. J. Kelly¹ reports 3 cases of carcinoma of the appendix and 1 of endothelioma of the appendix, in addition to those he previously reported from the service of Dr. Deaver.

Harte,² basing his statistics upon 101 cases, including 9 of his own or of his associates, comes to the following conclusions:

1. Primary carcinoma of the appendix is present in from one-third of 1 per cent. to 1 per cent. of all cases operated on for chronic appendicitis. But few cases are collected at autopsy.

2. Institutions that make a thorough microscopic examination of all appendices removed at operation and at autopsy will report a larger percentage of cases of carcinoma of the appendix.

3. Carcinoma of the appendix, especially of the basal or spheroidal cell type, is a condition of early life occurring generally between the age of ten and forty. There is little tendency to metastasis, and the origin of the disease is, as a rule, in the mucosa.

4. The disease appears to be slightly more frequent in females than in males.

5. Acute and chronic inflammations are present, and are responsible for the symptoms demanding operation. The growth when localized gives no pathognomonic symptoms.

6. The fact that primary carcinoma of the appendix takes its origin in an inflammatory process, forms a very strong argument for the removal of all appendices that show evidence of any irritation.

Intestinal Tuberculosis. Landis³ estimates the frequency of intestinal tuberculosis as a complication of pulmonary tuberculosis as not less than 60 per cent. Discussing the symptomatology of tuberculous enteritis, he emphasizes the unreliability of the occurrence of diarrhea as a

¹ American Journal of the Medical Sciences, 1908, No. 6, cxxxv, 851.

² Annals of Surgery, 1908, No. 6, xlvii, 968.

³ Transactions of the National Association for the Study and Prevention of Tuberculosis, November, 1907.

diagnostic aid. Among 33 cases that he studied, 4 had from six to nine stools daily, yet at autopsy showed no evidences of intestinal ulceration. On the other hand, no less than 13 showing ulceration at autopsy had but one to three movements daily, and in several the bowels moved but once every day or every other day. Moreover, the severity of the diarrhea did not stand in any direct relation to the size or number of the ulcers. Pain was rarely present; it is, however, an important symptom when it always occurs in the same spot, and especially when it is increased by pressure. Rigidity of the abdominal muscles is equally uncertain and unreliable.

Landis does not place much value upon the presence of tubercle bacilli in the feces as an indication of tuberculous enteritis. They are always present in patients with intestinal ulceration, but they are also frequently present in patients with pulmonary tuberculosis without any intestinal ulceration. Occult blood in the feces is another sign of doubtful diagnostic significance in tuberculous enteritis. Landis found ulcers present in all of the cases in which occult blood was present, but in about half the cases in which there was ulceration the occult blood test was negative. He mentions that if the cases had been examined more frequently a larger number would probably have given a positive response.

ILEOCECAL HYPERPLASTIC TUBERCULOSIS. Ulceration is such a frequent manifestation of intestinal tuberculosis that clinicians are inclined to look upon all cases of intestinal tuberculosis as ulcerative in nature. Pathology has taught us, however, that intestinal tuberculosis may manifest itself by other lesions than ulceration, by stenosis (not the result of the cicatrization of ulcers), and by the so-called ileocecal hyperplastic tuberculosis. Neither of these forms is by any means so common as ulceration; and their clinical manifestations are relatively little known. Hemmeter¹ devotes the greater part of a paper on intestinal tuberculosis to a discussion of the pathology and symptomatology of the ileocecal hyperplastic form of intestinal tuberculosis.

According to Conrath this condition was first described by Durant in 1890. The condition may arise in one of two ways: from the mucosa by extension of tuberculous intestinal ulcers; and from the serosa by extension of tuberculous lymph nodes. Pathologically there may be a moderate degree of ulceration and stenosis; but the predominating lesion is a low-grade proliferation of chronic inflammatory tissue resulting in extensive hyperplasia. It is less frequently a complication of advanced pulmonary tuberculosis than is simple ulcerative tuberculous enteritis. Conrath's statistics, based on 85 cases, show the condition to be most common between the ages of thirty and forty years.

Early in the disease the symptoms are so vague as to make a diagnosis impossible. Only when the disease progresses to such an extent that

¹ Journal of the American Medical Association, 1908, No. 9, p. 655.

stenosis occurs, can it be diagnosticated. Then there occurs localized or diffuse pain of an acute colicky character, constipation, nausea, vomiting, and frequently visible intestinal peristalsis. There is occasionally occult blood in the feces, and a moderate degree of fever is an almost constant symptom. The discovery of tubercle bacilli in the feces would naturally add great weight to the diagnosis. The tumor is at first more or less movable. Later it becomes fixed by adhesions or contracting bands in the mesentery. Instead of the lower border of the cecum being, as it normally is, about 1 cm. above the level of a line connecting the anterior superior spines of the ilia, it rises a number of centimeters above this level. This, according to Obrastzow, is due to a shortening of the colon as the result of the contraction of the scar tissue formed in the tuberculous focus. The diazo reaction is claimed by Krokiewicz to be almost constantly present in ileocecal hyperplastic tuberculosis.

The condition with which the ileocecal tuberculous tumor is most readily confused is carcinoma of the cecum or ascending colon. The differential diagnosis between the two diseases is tabulated by Hemmeter as follows:

	Cecum tuberculosis.	Cecum carcinoma.
Age . . .	Between twenty and forty years.	Rare before fortieth year.
Duration . .	From two to three years.	Eight to nine months.
Lungs . . .	Pulmonary tuberculosis more or less evident.	Negative.
Tumor . . .	Elongated; the intestine is palpable as an infiltrated, thickened cylinder.	Sharply circumscribed; intestines not palpable.
Stenosis . .	Always present; develops slowly accompanied by striking, splashing, and musical sounds.	Develops rapidly; acoustical signs not so pronounced.
Stool. . . .	Blood and pus rare; tubercle bacilli frequently present.	Blood and pus frequently observed; tubercle bacilli absent.
Fever	Generally present.	Exceptional.
Urine	Ehrlich's diazo reaction positive.	Diazo reaction negative.

Satisfactory results in treatment are to be obtained only by surgical procedures, otherwise the treatment of the condition is purely symptomatic.

Cause of Symptoms in Acute Intestinal Obstruction. There is great diversity of opinion regarding the cause of the violent symptoms consequent upon acute intestinal obstruction. Some writers consider them due to reflex disturbances set up by irritation of the nervous structures in the intestines. Others consider them to be the result of absorption of poisons from the obstructed intestines. Kukula secured at operation the contents of obstructed intestinal loops, filtered them through Chamberlain filters, and injected the filtrate into dogs. The results were negative, as a rule, although an alcoholic extract of this material produced symptoms of intoxication when injected into animals. These

symptoms were nausea and vomiting, diarrhea, sweating of the paws, and depression or collapse, and occasionally tonic or clonic convulsions, and paralysis of the hind limbs. These symptoms all gradually passed off.

Albeck found that the contents of an occluded loop of intestine were much more poisonous than those of the normal intestine, and he was able, by injecting the filtrate from this material into rabbits and cats, to produce diarrhea, convulsions, and collapse, with death in from four to fifteen hours. Boeszky and Generisch, in experimental obstruction of the colon in rabbits, found *Bacillus coli* in the peritoneal cavity in 45 per cent. of the cases; in the blood in 29 per cent.; and in both the blood and the peritoneal cavity in 17 per cent. When the small intestines were ligated, *Bacillus coli* were found in the peritoneal cavity in 28 per cent.; in the blood in 18 per cent.; and in both the peritoneal cavity and the blood in 9 per cent. On the basis of these experiments, they believed that the symptoms of acute intestinal obstruction are due to a general septicemia with intestinal bacteria. Clairmont and Ranzi obtained results very similar to those of Kukula. With the hope of throwing some light upon the question, McClure¹ undertook experiments along the same lines as those of Kukula and of Clairmont and Ranzi.

Obstruction was produced by ligating the intestine at various levels with a doubled cotton cord. In cases in which the obstruction was allowed to continue until the death of the animal, the greatly distended proximal loop was found in most cases to occupy the greater part of the abdominal cavity. The distended portion was intensely hyperemic, but there was, as a rule, no dulling of the peritoneal gloss, and whatever accumulation of fluid there was in the peritoneal cavity showed no coagulum of fibrin. In contrast with the results of Boeszky and Generisch, smears and cultures from the peritoneal cavity, heart's blood, liver, spleen, and kidneys showed no bacteria. The contents of the distended loop, on the contrary, showed astounding numbers of bacteria as contrasted with the number in the normal intestine at the same level.

McClure attempted the introduction of some of the contents of an obstructed loop into an isolated loop in another dog. It was found impossible, however, to confine in this loop an amount of fluid sufficient to produce any symptoms, since the active peristalsis set up by the irritating substances quickly led to its expulsion.

In other experiments the contents of the obstructed loops were passed through a Berkefeld filter and injected into the peritoneal cavity of dogs. None of these experiments led to a fatality, but intense symptoms of depression and apathy, sometimes with vomiting and straining move-

¹ Journal of the American Medical Association, 1907, xlix, 1003.

ments, occurred. The animals recovered completely by the next day and remained well. McClure remarks that the material that accumulates in the obstructed intestine does not seem to be very toxic in small quantities; and a single dose, even when injected intraperitoneally, may be withstood, although its continued absorption over a period of several days, as in clinical cases of obstruction, may naturally lead to death from the accumulative action of the poison. That these poisons are the product of the bacteria, and not merely stagnant digestive secretions, McClure attempted to show by an experiment in which the intestinal loops were so anastomosed with the stomach and with one another that the bile and pancreatic juice were diverted from the whole upper part of the intestine and poured into the lower ileum. Under these circumstances, if the obstruction were produced just above the anastomosis in the lower ileum, it was found that the symptoms occurred quite as rapidly as before.

In attempting to produce a condition analogous to the foregoing, without, however, producing an actual obstruction to the movement of intestinal contents, McClure isolated a loop of intestine in dogs, and subsequently closed the ends, the circulation being kept intact. In thirteen experiments of this nature death resulted in each case within a few days, with symptoms similar to those of obstruction. As the result of these experiments, although he admits that they are not finally conclusive, McClure believes that the symptoms consequent upon acute obstruction are due to the absorption of bacterial toxins.

THE RELATION OF CHRONIC GASTRIC CONDITIONS TO DUODENAL OBSTRUCTION. The hypothesis that acute dilatation of the stomach is primarily the result of occlusion of the duodenum by the root of the mesentery and the superior mesenteric artery, is considered by Codman¹ to have great clinical importance in relation to chronic obstruction. He contends that the relations of the root of the mesentery to the duodenum, when a person is standing erect or lying on the back, produces constantly a certain degree of obstruction of the duodenum by the root of the mesentery. This is not true of four-footed animals; for in them the tension on the root of the mesentery is always away from the duodenum; in man the tension is such as to compress the duodenum between the root of the mesentery and the spinal column. His contentions, as expressed by himself, are as follows:

1. That in the human being the transverse portion of the duodenum is more or less compressed by the root of the mesentery.

2. That slight anatomical deviations from the normal or certain pathological conditions may increase this pressure to a varying extent up to the point of complete occlusion of the gut.

3. That when this pressure reaches a degree great enough to give

¹ Boston Medical and Surgical Journal, 1908, clviii p. 503

more resistance to the muscular efforts of the duodenum than the closed pylorus, the condition becomes of pathological significance.

4. That thus, anatomically, the duodenal secretions are brought into contact with membranes unfitted physiologically to withstand their corrosive action.

5. That the obstruction favors stasis in the duodenum, and thus bacterial invasion of the tissues.

6. That if the foregoing propositions can be proved they will materially alter the present conceptions of the etiology and treatment of a variety of pathological conditions, *e. g.*, hyperchlorhydria, nervous dyspepsia, duodenal and gastric ulcer, pancreatitis, cholelithiasis, persistent vomiting after laparotomy and in pregnancy, and excessive fluid drainage from wounds in the common duct and duodenum.

One great difficulty in the acceptance of this view is that acute dilatation of the stomach is relatively rare, while if Codman's theory were true it would seem that it should be common, and especially it should be associated with these other conditions mentioned in which he thinks his views may be of importance.

In support of his view, however, Codman presents the casts of a number of duodena that show a distinct compression at the point where the root of the mesentery crosses them. In answer to the contention that Nature would hardly have placed the duodenum in such a preposterous position without providing some way of avoiding the consequent pressure, Codman emphasizes the fact that this arrangement was originally intended for four-footed animals, whose horizontal position would not impose this obstruction on the duodenum. With the erect position and the conventionalities of dress assumed by civilized races, however, the relation of the root of the mesentery to the duodenum assumes a pathological significance.

The conditions to which, according to Codman, this obstruction may give rise, depend upon the degree of obstruction and the action of other closely related parts of the digestive tract. If there is but a very mild degree of obstruction, the muscular wall of the duodenum may hypertrophy sufficiently to overcome this partial obstruction, and in this way the condition would remain devoid of any clinical significance. If, however, the obstruction is of a high grade, various phenomena may ensue, depending mostly upon the action of the pylorus. If the pylorus remains firmly closed, we have a tube, the contents of which are subjected to pressure, which can find an outlet in only one direction—through a relaxed duodenal papilla. Thus, Codman thinks irritating materials, including bacteria, may be forced through the duodenal papilla and give rise to cholelithiasis, cholangitis, and pancreatitis. If, on the other hand, the papilla does not permit the ingress of duodenal contents, there still remains the active peristalsis of the hypertrophied duodenal wall, which may give rise to pain and disturbances of digestion, usually

interpreted as being due to nervous dyspepsia, hyperchlorhydria, and other gastric neuroses. Even when the pylorus remains open the same phenomena may result, for here we have the active peristalsis of the stomach attempting to force the gastric and duodenal contents past a more or less high degree of obstruction. A still further possibility, Codman thinks, may result from this form of chronic obstruction when the pylorus remains open, namely, gastric ulcer. This, he believes, may result partly from the digestive action of the pancreatic juice on a mucous surface not specifically equipped to withstand its action, and partly from the influence of bacteria multiplying in the stagnated duodenal contents.

Dynamic Ileus. Most interesting and instructive experiments were carried out by Cannon and Murphy¹ on dynamic ileus. Ileus, according to Nothnagel's classification, is divided into mechanical ileus in which there is actual occlusion of the intestine, and dynamic ileus in which there is the syndrome of occlusion of the bowel without, however, obliteration of the lumen. Cannon and Murphy's experiments concern only dynamic ileus. The question in particular that they attempt to solve is whether dynamic ileus is of central or peripheral origin. The predominating feature of dynamic ileus is a failure of normal peristalsis. Peristalsis is a coördinated movement, the intrinsic control of which, as has been shown by Magnus, is in Auerbach's plexus. The central nervous system exerts its control over these movements through the innervation of the splanchnic nerves.

DYNAMIC ILEUS THROUGH THE CENTRAL NERVOUS SYSTEM. When the nervous connections between the alimentary canal and the central nervous system are intact, nothing is more remarkable than the responsiveness of the canal to conditions of general asthenia. In the asthenia of animals afflicted with "distemper," for example, food will lie in the stomach or intestines all day without the slightest sign of a peristaltic wave passing over it. There is total cessation of the motility of the digestive organs. The condition is quite different, however, when the canal is disconnected from the spinal cord and brain, as Cannon and Murphy were well able to observe in an extremely asthenic dog suffering with a deep septic process in the muscles of the neck. After severing the splanchnic nerves they were able to watch the peristaltic movements and the progress of food through the gastro-intestinal tract by means of the x-rays, and found that the rapidity of its movement was not less than in a normal dog.

They were able to prove by direct experiment the existence of reflex or central dynamic ileus. Two sets of male cats were etherized for the same length of time. The testicles of one set were crushed, while the other set were allowed to come out of ether without any operative inter-

¹ Journal of the American Medical Association, 1907, xlix, No. 10, p. 840.

ference. Comparing the passage of food contents through the intestines in the two sets, it was found that in those in which the testicles had been crushed it was much slower than in those that had merely been etherized. Performing the same experiment upon cats whose splanchnic nerves had first been cut, the peristaltic activity as measured by the passage of food masses was approximately the same as in the animals in which there had been no operation. These experiments prove that dynamic ileus can be produced without mechanical changes in or about the intestinal wall, the condition being one of inhibition, the inhibition being conveyed to the intestinal tract through the splanchnic nerves.

DYNAMIC ILEUS BY MEANS OF LOCAL PARALYSIS. In an earlier research Cannon and Murphy showed that etherization and exposure of the stomach and intestines to the air caused no noteworthy delay or decrease in the peristaltic movements. Handling of the intestines, however, even to the slightest extent, did produce delay and decrease of the peristaltic movements. It was found, moreover, that this retardation and decrease were greater when the intestines were handled in the air than when they were fingered in the peritoneal cavity or under warm normal salt solution. To determine whether these phenomena were of central or peripheral origin, the same manipulations were practised on animals whose splanchnic nerves had been cut. It was found that the same phenomena occurred, showing them to be of local and not of reflex origin.

Having determined that dynamic ileus may be of either central or peripheral origin, it is of great importance, from the standpoint of treatment, to determine, if possible, the means of recognizing in any particular case which of these two origins is responsible for the condition. Since the splanchnics carry only inhibitory impulses, if the ileus is of central origin, any agent that will check the delivery of inhibitory impulses from the cord to the intestinal canal by means of the splanchnics will permit the canal to resume its normal function. If, on the other hand, the activity is the direct result of a local disturbance, this same agent will have no effect in promoting the restoration of peristalsis. In studying this phase of the subject, Cannon and Murphy found that tincture of aloes, which Pfaff and Nelson found to be particularly effective in promoting peristalsis in the cat, had no effect upon an ileus of peripheral origin. On the other hand, when the inhibition was imposed from the spinal cord, it was found that *salicylate of physostigmine*, when administered after etherization, was able to incite peristalsis. The effect of physostigmine, however, was of but short duration. Within two hours its effect had apparently passed off.

From their results Cannon and Murphy believe that there is some question as to the reasonableness of attributing great efficacy to a single dose of physostigmine in clinical cases, when the passage of feces occurs from eight hours to three days after the administration of the drug.

However, there is no doubt that temporarily, at least, the salicylate of physostigmine will overcome reflex inhibition of the alimentary canal and cause the normal movements to proceed. They hope that their future experiments will throw more light upon these questions. The point especially to be emphasized as the result of their experiments is the importance of the distinction between dynamic ileus of spinal origin and dynamic ileus of local origin in the intestinal wall.

EARLY SYMPTOM OF ILEUS. Ewald¹ calls attention to an early symptom of ileus that he thinks has been generally ignored by clinicians. This symptom is the early and rapid filling of the stomach with fecal intestinal contents. To determine both how early and how rapidly this occurs, the stomach must be washed out. One should not wait for fecal vomiting. Ewald claims that by means of the stomach tube one may in this way frequently make a diagnosis of ileus at a stage when hardly any other symptoms are present to indicate its existence. He furthermore recommends frequent washing of the stomach as a therapeutic measure. The relief of the symptoms of toxemia as the result of this measure is frequently astounding.

Torsion of Epiploic Appendage. Krüger² reports a case of torsion of an epiploic appendage in a hernial sac requiring operation, and Briggs³ a similar condition in the abdominal cavity. This brings the cases of torsion of appendices epiploicæ requiring operation to the number of fifteen. Twisted epiploic appendages or those lying free in the peritoneal cavity, the so-called corpora aliena, are not infrequently found at autopsy; but it is only within the last few years that the condition has become one of clinical significance. We are indebted to Riedel for most of our knowledge upon the subject.

The cases of torsion of appendices epiploicæ may be divided into two classes: the intra-abdominal and the hernial. Of the 15 cases that have been reported, 7 were intra-abdominal and 8 hernial. Briggs further divides the intra-abdominal type into those in which the distal extremity of the appendix epiploica is adherent and those in which it is non-adherent. The adhesions usually result from circulatory disturbances caused by the progressive narrowing of the pedicle, thus producing inflammation of the distal extremity. If the pedicle becomes atrophied and the distal end is not adherent appendices may lie free in the peritoneal cavity, and have thus been known to give origin to a peritonitis. They have also been known to undergo calcareous degeneration. In the hernial group of cases the epiploic appendages may become incarcerated in a femoral or inguinal hernia, most commonly on the left side. Of the 8 hernial cases that have been reported, 7 occurred on the left and 1 on the right.

¹ Berliner klin. Wochensh., 1907, Nr. 44, p. 1416.

² Münch. med. Woch., 1907, liv, 1813.

³ American Journal of the Medical Sciences, 1908, cxxxv, 864.

This relative frequency of left-sided cases is due to the fact that the sigmoid is much more movable than is the cecum.

There is little by which the pathological conditions of appendices epiploicæ can be recognized before operation. When in a hernial sac the symptoms are usually those of strangulation. When in the abdominal cavity the symptoms are those of inflammation, which may simulate appendicitis, cholelithiasis or cholecystitis, or inflammation of other intra-abdominal organs.

Diverticulitis. Within the past few years acquired intestinal diverticula have attained a position in medical and surgical diagnosis that had previously not been accorded them. As is well known, acquired diverticula occur in elderly persons, usually the subjects of constipation. They are generally localized about the lower portion of the descending colon and the sigmoid. They were looked upon as a not uncommon pathological finding in persons of the type already mentioned, but no pathological significance was attached to them. Lately they have been recognized as the not uncommon cause of previously obscure phenomena located in the left iliac region. The conditions to which they give rise may be divided into two types: the inflammatory and the hyperplastic, or tumor-like. In the first type the symptoms, excepting for their location, resemble more or less those of appendicitis. In the second type the symptoms are of slower progression, and resemble carcinoma of the sigmoid or lower portion of the descending colon.

The pathology of the affection is as follows: The diverticula are hernia-like protrusions of the mucosa and submucosa through the muscularis, at a point where bloodvessels enter the intestinal wall from the mesentery. Fecal concretions collect in the diverticula, and by irritation give access to the pathogenic activity of the intestinal bacteria. If the virulence of these bacteria is of low grade and their activity is limited to the intestinal wall, the hyperplastic type of diverticulitis results and a condition resembling carcinoma of the sigmoid presents itself. If, however, the virulence of the organisms is greater, and they penetrate the wall and exert their activity on the peritoneal coat, then a localized form of acute peritonitis results, when the condition resembles a left-sided appendicitis.

Brewer¹ cites the histories of six cases of the acute inflammatory type of diverticula that have come to his notice within the last ten years. Only lately has he come to recognize the nature of these cases, but his more recent observations have convinced him of the fact that his earlier cases were instances of acute diverticulitis. One of these is so characteristic that it is deemed worth citing in some detail.

The patient, S. D., aged forty-five years, had always enjoyed good health. He had never suffered with digestive disturbances suggesting

appendicitis, cholelithiasis, or peritonitis. In August, 1902, while at dinner, he was suddenly seized with an attack of abdominal pain, nausea, and faintness. The attack soon passed off, but the following night proved a restless one, and he had more or less constant pain in the lower portion of the abdomen, which prevented sleep and at times was accompanied by nausea and general bodily weakness. Despite these symptoms he continued to be up and about the following day. Later that day he went for a drive, and suffered acutely from the jolting of the vehicle. In the evening he was obliged to call a physician, who pronounced the case one of colitis. The following day the symptoms continued, and during the ensuing five days he still suffered with pain in the lower left quadrant of the abdomen, fever, and general malaise. When first seen by Brewer the temperature was 103°; the pulse, 110; the leukocytes, 17,000. There was marked rigidity of the left rectus muscle and a tender mass in the left iliac fossa. He was removed to a hospital, and under ether an incision was made over the most prominent portion of the tumor. After dividing the tissues of the abdominal wall a large abscess cavity was entered, which contained about 120 c.c. of foul pus and an oblong fecal concretion. On washing out the abscess cavity a small ulceration was seen in the wall of the sigmoid through which escaped a small amount of fecal matter. The cavity was packed with sterile gauze, the wound partially united, and a dressing applied. The patient made a gradual, but complete recovery.

THE PERITONEUM.

Abdominal Pain. Lennander,¹ in his address before the Section on Surgery and Anatomy of the American Medical Association, at its meeting in 1907, presented a thorough review of the newer theories, in the development of which he has been a leader, in regard to abdominal pain. In substance, the newer views are that the abdominal viscera and the visceral layers of the peritoneum are entirely insensitive to pain, and that pain referred to these organs is appreciated entirely by the parietal layer of the peritoneum. Although it possesses the pain sense, the parietal peritoneum in all probability does not respond to either pressure or temperature stimuli. Lennander has been frequently able to observe in the course of operations that the manipulations that cause pain are those that occasion stretching of the parietal peritoneum and the parietal attachments of the mesenteries. For example, pain is occasioned by the placing or removal of gauze compresses between the viscera and the parietal peritoneum, by the dragging forward of the cecum, of the vermiform appendix, or of any other organ whose normal

¹ Journal of the American Medical Association, 1907, xlix, 836.

attachment to the abdominal wall is put on the stretch. The same principle applies to the stretching of any abdominal adhesions that may connect the viscera with the abdominal wall. On the other hand, should a compress lie between the viscera, without coming into contact with the abdominal wall, the patient experiences no sensation when it is removed. Similarly, no sensation attends the stretching or breaking up of adhesions that have no connection with the abdominal parietes.

The theory of colic formulated by Nothnagel, which has received almost universal acceptance, is that the pain is due to spasm of the muscular coat of the bowel or to anemia of the intestinal wall. Observations, however, on human beings suffering with intestinal fistulæ do not support this opinion. Various stimuli applied to the portion of intestine lying outside the abdominal cavity evoke no pain so long as this stimulus affects the intestine alone. When, however, the contracting bowel drags on adhesions connecting it with the abdominal wall, pain at once results. The view that the colicky pain is due to pressure on the nerves of the intestinal wall, in consequence of a tonic spasm of its muscular coat, is disproved by the fact that the intestinal wall can be crushed with a strong pair of forceps without any sensation being elicited. Lennander further believes that the pain cannot be due to anemia of the intestinal wall resulting from spasm of its muscular coat, since it is possible, by means of electric stimuli, to produce so powerful a contraction of the bowel that it becomes of tumor-like hardness and assumes a yellowish-white color from anemia without the patient's experiencing any sensation whatever.

Lennander agrees with Wilms that the pain of intestinal colic is due entirely to the stretching of the mesenteric attachments of the portion of the bowel affected. As the bowel attempts to contract around its contents in front of the stricture it endeavors to assume a straight form, and in doing so is obliged to pull upon its mesenteric attachment. Lennander had the opportunity of observing this very clearly in a patient in whom he was resecting more than three feet of the ileum, together with the cecum and a portion of the colon, under local anesthesia. Before this portion of intestine was excised it was completely freed from adhesions, only the normal mesenteric attachment being left. A portion of the ileum about 40 cm. long was clamped and inflated with air. It immediately straightened itself out, the mesentery became stiff and assumed a fan-shaped form. At this time the patient complained of pain, which passed off as soon as the bowel was emptied of air. Then a portion of the ileum too short to produce any stretching of the mesentery was inflated to the extent of causing the serous membrane to burst, without causing the patient any discomfort.

Lennander has frequently had the opportunity of slightly displacing the serous membrane of the anterior abdominal wall against the muscles or aponeurosis while the patients were under local anesthesia. The

almost invariable response of the patient to this manipulation was that it felt like a cramp or a griping pain. It is Lennander's view that the nerves concerned in the appreciation of pain referred to the abdomen are the cerebrospinal nerves supplying the parietal serous membrane and subserous connective tissue, and that the sympathetic fibers and the various nerves supplying the abdominal viscera are in no way concerned in this function.

Tuberculous Peritonitis. Attention was first called to the value of simple laparotomy in tuberculous peritonitis by König in 1884. Six years later he reported the results of this form of treatment in 131 cases, 64 per cent. of which he claimed to have been cured. Soon other reports on the value of this form of treatment followed. The beneficial effect of the laparotomy was variously attributed to mechanical irritation, to the removal of the exudate, and to the simple contact with air. In 1899 Wunderlich presented a paper criticising the procedure. He claimed that patients had been judged cured before sufficient time had elapsed to exclude a recurrence. According to his opinion three years should elapse without a return of symptoms before the patient can be said to be cured. Under these conditions he stated that but 23 per cent. of the reported cases could be considered as having been cured. Later, others opposed the operative treatment and many contributions appeared reporting the frequency of spontaneous recovery. Borchgrevink reported 88 per cent. of recoveries in 22 cases treated conservatively.

Schmidt and Meyer, in their investigations on intraperitoneal injections, noted that a single injection of *oxygen* into the peritoneal cavity of patients suffering with tuberculous peritonitis was sufficient, in several cases, to induce total disappearance of the symptoms. Schulze¹ reports the results of 7 cases treated by this method in Schmidt's clinic. Of the 7 cases, 6 were followed for from one and one-half to two years after this treatment. All 6 were, after the lapse of this period, well and able to perform their work. In 5 of the patients one injection was sufficient to cause complete and permanent disappearance of the ascites. In the sixth case a second injection was necessary. The injection was well borne by all the patients. In about half of them mild, temporary symptoms of peritoneal irritation, pain, vomiting, and slight diarrhea manifested themselves.

Schulze is unable to explain satisfactorily the action of the injected oxygen in these cases. It may be that it acts as an irritant, inducing hyperemia of the peritoneum; or it may be the chemical effect of the oxygen on the exudate or the organisms contained in it. The technique of the injection consists in first withdrawing any fluid that may be present in the peritoneal cavity, and then injecting the purified oxygen by means of a specially devised apparatus described by Schulze.

¹ Mitth. a. d. Grenzgeb. d. Med. u. Chir., 1907, xviii, 150.

THE PANCREAS.

Secretory Activity of the Pancreas. Burkhardt¹ reports some experiments of the greatest interest in regard to the secretory activity of the pancreas. It has for a long time been known that a small transplanted portion of the pancreas is capable of thoroughly inhibiting a diabetes in an animal from which the organ had previously been excised. This phenomenon was attributed to the fact that the gland had a double secretion, an internal and an external, the former of which is concerned in the glycolytic function. This function can be maintained by a portion of the gland situated anywhere within the body. It appeared, however, from the work of Abelman that these transplanted portions of pancreas, even when their excretory ducts did not lead into the intestinal tract, had some influence upon digestion and absorption.

The same observation was made later by Pflüger and Lombroso. Since, however, in the experiments of these observers, it was impossible to exclude the introduction of small amounts of pancreatic secretion into the intestines or into the general blood circulation, Burkhardt performed his experiments as follows: After total removal of the pancreas a small portion of the gland was implanted into the subcutaneous tissue in such a way that its excretory duct led to the free surface of the body. Under these circumstances the secretion could be allowed to flow into a receptacle; or the duct could be left open and the dog allowed to lick the secretion; or the duct could be ligated and the secretion retained within. After determining that the secretion of the gland was of good digestive power for both fat and proteid, the dog was fed in such a way that the absorption of proteid and fat could be determined when the duct was ligated, when the secretion was collected, and when the dog was allowed to lick it. The results are condensed in the following table:

	Percentage of absorption.	
	Proteid.	Fat.
Normal dog	98	96
Dog allowed to lick fistula	86	79
Duct ligated	62	68
Secretion collected and removed	46	13

It is thus seen that when the dog is allowed to lick the fistula, the secretion thus entering the gastro-intestinal tract, the absorption was only slightly less than normal. When the secretion was entirely removed from the body, absorption was greatly lessened. When, however, the duct was ligated and the secretion could thus find its way into the circulation, absorption, especially of fats, was much more complete though not so thorough as when the dog was allowed to lick the fistula.

¹ Arch. f. experim. Path. u. Pharmak, Band lviii, Heft 3 und 4.

Just how the secretion of the pancreas implanted in this way acts it is difficult to say. One might think that the ferments are formed elsewhere in the body and are merely secreted by the pancreas; but this is improbable, by reason of the fact that after total extirpation absorption is most limited. It is, therefore, he says, most probable that the ferments are formed in the pancreas, and by way of either the lymph or the blood are finally conducted to the intestines. It is quite possible, however, that the action is not exerted directly as through actual ferments, but by secreting some stimulus, similar to secretin, that excites the activity of the intestine to the secretion of succus entericus or that aids absorption processes. Burkhardt's experiments prove conclusively that the ferments of the pancreas concerned in proteid and fat digestion are furnished to the body in the form of an external secretion, whether they are brought to the intestinal tract directly or indirectly.

Pancreatitis. Polya¹ takes up the frequently discussed question of the actual cause of the tissue necrosis in destructive pancreatic lesions, and reports the results of his experiments in attempting to solve the question. Intimately associated with this question is naturally that of fat necrosis, for profound lesions of the pancreas and fat necrosis are associated phenomena in the vast majority of cases.

There are, in the main, two views in regard to the etiology of acute destructive lesions of the pancreas: one of them, that bacteria entering the gland from the intestinal tract exert their destructive action upon its tissue; the other, that it is a digestion of the tissues by the pancreatic secretions themselves. Clinicians in general favor the first of these views; but the second is more in accord with both experimental evidence and the views of most of the pathologists working on the question. Injections of microorganisms have seldom produced characteristic lesions. The circulatory disturbances with which some investigators are inclined to associate autodigestion of the gland in an etiological way have, in experiment, produced varied results—at times, positive; at times, negative—but never of a very definite nature.

The most recent experiments point strongly to the possibility that the pancreatic secretion, which normally possesses no proteolytic activity within the gland, becomes activated and thus assumes the power of digesting the proteid of the gland itself. Polya has undertaken his experiments with the hope of deciding this question and, if possible, of determining the substance that activates the pancreatic secretion. Both a commercial trypsin preparation and freshly obtained pancreas secretion from a dog were used in the experiments. The *trypsin* preparation, which was first determined to have active proteolytic properties, produced in practically all cases rapid destruction of the gland, with the symptoms common to such lesions. Subsequently, some of the same

¹ Pflüger's Arch., 1903, cxxi, Heft 9 und 10.

preparation was made inactive by heat so that it had no digestive action on egg albumin, and it was practically without action when injected into the pancreas. Subsequently, partially inactivated trypsin was injected and corresponding to this moderate activity the dogs presented lesions of but moderate degree.

The *fresh pancreatic secretion* was obtained in two ways: with a funnel as recommended by Pawlow, and by a catheter introduced into the duct as recommended by Delezenne. The secretion obtained in the latter way was found to be entirely inactive when tested by Mett's method, whereas that obtained by the funnel showed active proteolytic properties. Seven dogs were injected with 3 to 5 cm. of the juice obtained with the funnel. Four died within twenty-four hours, with the typical symptoms and lesions of acute pancreatitis; a fifth in thirty-six hours; a sixth in two days; and the seventh in eleven days. The two dogs injected with the secretion obtained by means of the catheter showed absolutely no symptoms or signs suggestive of a pancreatic lesion. This complete correspondence between the severity of the lesions and the tryptic activity of the injected substance, as determined in vitro, leads Polya to the conclusion that acute destructive lesions of the pancreas are a result of the digestion of the gland by its own activated secretion.

On the basis of his own experiments, as well as those of others, he is convinced that the action of the trypsin is purely a local one, and that the profound symptoms resulting from his influence are due to the absorption of the substances liberated by the necrotic gland. Polya sums up the results of his experiments as follows:

1. Trypsin solutions, which possess a powerful proteolytic activity, produce, when injected into the pancreas, profound changes in the gland (necrosis and hemorrhage), and their consequences (fat necrosis and death); whereas, solutions of less proteolytic activity produce either milder changes or none at all.

2. Trypsin solutions inactivated by heat lose their pathogenic properties and, when injected into the pancreas, produce no lesions of consequence.

3. Fresh activated pancreas secretion, when injected into the pancreas, produces the same changes as the trypsin solution of powerful proteolytic activity, while inactivated pancreas secretion produces no changes.

4. The active agent in these experimental diseases of the pancreas is the proteolytic pancreas ferment trypsin.

Williams and Busch¹ also favor the view that the necrosis of pancreatic tissue is due to the digestive action of activated pancreatic juice. They conducted a series of experiments to determine what this activating agent may be and how it gains access to the pancreas. Their first experiment consisted in an attempt to force duodenal contents through the ampulla of Vater into the duct of Wirsung. They ligated the duo-

¹ Journal of Medical Research, 1907, xii, 35.

denum of nine human cadavers, filled the duodenum with an eosin solution, and by compression attempted to force this solution up the duct and into the pancreas. In only one instance were they successful in doing so. This occurred in a subject with gallstones and dilatation of the ducts; death occurred forty-eight hours before these experiments were made, and the organs had been removed from the body so that the conditions were not entirely normal.

In the second series of experiments they tested the possibility of producing pancreatitis by injecting duodenal contents directly into the pancreatic ducts. This experiment was performed on 10 animals. In 4 cases the result was negative; in 3, areas of fat necrosis in moderate numbers were found; in the remaining 3, pancreatitis occurred. They next attempted to dilate the bile ducts and ampulla of Vater in animals by forcing small glass cones through the duct to imitate the passage of gallstones. Subsequently to this procedure they compressed the duodenum to force its contents up the duct into the pancreas. In 3 cases so manipulated the passage of duodenal contents into the pancreatic ducts were perfectly evident. Of the 7 animals upon which these experiments were made, 4 showed varying degrees of pancreatitis and fat necrosis. The remaining 3 presented no changes. In 2 additional cases, after the forced passage of glass beads, no attempt was made to force duodenal contents up the duct. One of these animals died at the end of two days, with well-marked pancreatitis and fat necrosis; the other, killed at the end of a week, showed only moderate fat necrosis.

Assuming from these experiments that duodenal contents or secretions have some influence on the production of pancreatitis, Williams and Busch undertook to determine whether *enterokinase*, the normal activator of the pancreatic juice, derived from the duodenum, was the responsible agent. They prepared emulsions of the duodenal mucous membrane, and rendered them sterile by filtration through a Berkefeld filter. Testing the power of this filtrate to activate pancreatic juice, they found it to be considerably less than that of the unfiltered material; 2 to 2.5 c.c. of the filtrate was injected into the pancreatic ducts of each of six cats. The results in all the cases were negative. The experimenters call attention to the diminished activating powers of this filtrate, and to the possibility of its escape into the duodenum before it had time to cause damage to the pancreatic tissue. They finally suggest the possibility of the pancreatic ducts themselves being able to activate pancreatic secretion. To determine this possibility, the carefully dissected ducts of human cadavers were mixed with extracts of the pancreas from the same bodies. Of 16 cases the ducts showed some power to activate pancreatic juice in 6, though in no instance was it all marked.

It may well be that the infectious theory and the view that trypsin is

the active agent are both correct and that the two act together, products of bacteria possibly activating the trypsin, or infectious inflammatory processes leading to the entrance from the digestive tract of substances that cause activation of trypsin.

COLLAPSE IN PANCREATITIS. Of no less interest than the cause of acute pancreatitis is the cause of the profound collapse occurring in these cases. Various views have been presented to explain it. The two most plausible are those that attribute it to trypsin and to the liberation of toxic products from the necrotic pancreatic tissue. One of the most prominent phenomena in the collapse attending acute hemorrhagic pancreatitis is the fall of *blood pressure*. Egdahl¹ conducted a series of experiments to determine what effect the injection of pancreatic extracts had upon the blood pressure of dogs. These extracts were divided into two classes: (1) Those giving the biuret reaction; (2) those not giving the biuret reaction. Injections of pancreatic extract giving the biuret reaction produced a marked fall in blood pressure, considerably more than was produced by trypsin or peptones alone. The injection of pancreatic extracts not giving the biuret reaction produced even a greater fall in blood pressure than did those giving the reaction. This suggests that the cause of the profound collapse in acute pancreatitis lies among the simple aromatic and amino compounds. Egdahl thinks that peptones and trypsin, as well as the stretching of the peritoneum and the irritation of the celiac plexus, may be contributing causes.

The conditions in these experiments are, however, so different from the complex conditions in pancreatitis that the results are scarcely more than suggestive.

TREATMENT OF PANCREATITIS. Eloesser,² in an exhaustive article on diseases of the pancreas, discusses the surgical treatment of *acute hemorrhagic pancreatitis*, which is of as much importance to medical clinicians as to surgeons. Until 1903 the recognized treatment consisted in the administration of stimulants and morphine during the acute attack, delaying operative measures until an abscess had formed. In 1903 Nahn recommended early operation, removing the ascites and tamponing the lesser omental cavity. Later, Mayo Robson recommended operation as soon as the diagnosis is established, without waiting for the disappearance of the shock that almost invariably attends the condition. He advises either a median incision from xiphoid to umbilicus, or a left costovertebral incision under local anesthesia when possible.

In deciding upon the treatment to be adopted, one must naturally judge whether the patient will be harmed more by the shock of the operation than by the retention of a mass of highly toxic material. It cannot be denied that the operation constitutes a profound shock

¹ Journal of Experimental Medicine, 1907, ix, 385.

² Mitth. a. d. Grenzgeb. der Med. u. Chir., 1908, xviii, 195.

for a patient in the early stages of an acute hemorrhagic pancreatitis. On the other hand, the conditions, excepting for the prostration, are extremely favorable for the early operation, for we are dealing with a toxic but not an infectious mass, so that there is practically no danger of the operation leading to a general purulent peritonitis. In the expectant plan the best that can be hoped for is the development of a peripancreatic abscess. Absorption of the exudate can be looked for only in the very mildest cases; and it is impossible to diagnosticate with any degree of certainty the severity of the process from the clinical phenomena. Furthermore, infection of the exudate takes place so readily from the intestinal tract that when the case is not operated upon early, the danger of extensive retroperitoneal suppuration is imminent. In one of Mayo Robson's cases and in one of Eloesser's there was retroperitoneal suppuration extending from the diaphragm to the pelvis. In early operations occasionally a small exudate, capable of being absorbed, will be found; but in this type of case the operation does little harm because the toxemia and shock from the pancreatitis are usually not so great as in those cases characterized by larger exudates.

The question is, moreover, complicated by the fact that in the majority of cases an absolute diagnosis of acute hemorrhagic pancreatitis cannot be made. There is always the possibility of the condition being an intestinal obstruction, perforative peritonitis, or a ruptured tubal pregnancy. As all these diseases require an early operation, there is so much more in favor of the early surgical interference in cases suspected of being acute hemorrhagic pancreatitis. In consideration of all these facts, Eloesser recommends, in all cases of suspected acute hemorrhagic pancreatitis, early operation, excepting when the patient is fatally shocked.

Chronic Pancreatitis. Walko,¹ discussing chronic pancreatitis, says that it undoubtedly occurs more frequently than is usually recognized, on account of the fact that it is produced by such varied causes. Among the most prominent of these are syphilis and alcohol. Other agents are ascending infections from the intestines; infections carried by way of the bloodvessels, as in mumps; any obstruction to the outflow of pancreatic juice, as by stones, inflammatory or fibrous stenoses, or contractures of the sphincter of the duodenal papilla. One of the commonest causes of pancreatitis is, of course, the extension of inflammations from the biliary ducts. The common association of cholelithiasis and pancreatitis is, in all probability, the result of a common cause acting upon both organs, producing in the one a low-grade inflammation, and in the other inducing the formation of stones. Bardenheuer and Sandler have called attention to the occurrence of chronic pancreatitis following trauma, and Niederle emphasizes the possibility of a chronic pancreatitis resulting from a latent acute inflammation.

¹ Arch. f. Verdauungskrankheiten, 1907, xiii, 497.

The commonest symptoms of chronic pancreatitis are epigastric tumor, icterus, and various types of epigastric pain. The latter, which may assume the form of either biliary colic or painful pressure, is one of the earliest symptoms of the affection. These pains are explained on the basis of pressure of the swollen pancreas on the solar plexus, a localized peritonitis, or a neuritis of the pancreatic branches of the solar plexus. Other frequent symptoms are those more distinctly referable to digestive disturbances, such as nausea, regurgitation of food, vomiting, the feeling of pressure in the region of the stomach, constipation or diarrhea, irregular fever with chills, at times subnormal temperature, and loss of weight. None of the symptoms mentioned will permit an absolute diagnosis to be made in the vast majority of cases.

It is only when the positive signs of disturbed function of the pancreas appear that the question of diagnosis can be seriously entertained. Such signs are the occurrence of glycosuria and deficient fat and proteid digestion. Even these, however, are at times difficult of interpretation, for it appears from some of the reported cases of apparently total destruction of the pancreas, that the vicarious action of other organs can replace that of the pancreas. Furthermore, in many cases of pancreatitis but a portion of the gland is destroyed, the remaining portion being able to perform the function ordinarily performed by the entire gland. Steatorrhea of pancreatic origin differentiates itself from that of biliary origin by the presence of biliary coloring matters and the occurrence of neutral fat (although the latter point especially is uncertain). Walko has found the *muscle nucleus test* to be of considerable value in the diagnosis of chronic pancreatitis. Some of the more unusual symptoms that are at times of value are the severe degree of anemia, bronzing of the skin, and sialorrhea pancreatica, which is in all probability a reflex phenomenon manifested by the diseased pancreas. Despite these various symptoms the diagnosis can frequently be made only after exploratory incision. Even then Walko emphasizes the difficulty of differentiating chronic pancreatitis with hyperplasia from carcinoma of the pancreas.

The secretory activity of the stomach has not been thoroughly investigated in cases of chronic pancreatitis. Of Walko's 16 cases, 8 showed absence of free hydrochloric acid and pepsin, 3 showed hyperacidity, and the remaining 5 exhibited normal secretion. He calls attention to the fact that all but 1 of the latter were cases of very short duration. Since in the majority of the cases in which the secretory activity of the stomach was decreased, there was no mechanical action of the pancreas which could be held responsible for it, it is probable that the deficient functioning power of the pancreas has a depressing influence upon the stomach.

Duodenal stenosis, resulting from compression by the diseased pancreas, has been noted in a number of cases. Duodenal ulcers, at times

the seat of extensive hemorrhages, have also been noted in association with chronic pancreatitis. Icterus and swelling of the liver, which frequently accompany chronic pancreatitis, may be results either of compression of the common bile duct by the head of the pancreas, or the coincident existence of gallstones. Walko lays especial emphasis upon the severe degree of anemia, which he has frequently noted in chronic pancreatitis. In 4 cases sudden attacks of unconsciousness, which could not be explained on the basis of cachexia, were a prominent feature. In 2 of his cases which were finally cured, 1 by operation and the other without, Walko noted peculiar painful tumor-like deposits in the *panniculus adiposus*, suggesting a marked resemblance to Dercum's disease. Medical treatment has proved useful in some cases, but in a great many operation offers the only hope of cure. A simple laparotomy seems to have been sufficient in many cases, while in others drainage of the bile ducts has been the apparent means of cure.

CHRONIC PANCREATITIS AND CATARRHAL JAUNDICE. Mayo Robson,¹ in discussing pancreatic catarrh and interstitial pancreatitis in their relation to *catarrhal jaundice* and also to glycosuria, leans strongly to the view that catarrhal jaundice, which in the past has usually been looked upon as the result of inflammation of the gall ducts themselves, is probably in many cases of pancreatic, rather than cholangitic origin. Though it is difficult to prove the inflammation of the pancreas and the consequent obstruction of the duct to be the cause of the jaundice in the acute cases, Robson thinks that there is sufficient evidence to prove that the vast majority of cases of so-called chronic catarrhal jaundice are the result of chronic pancreatitis. In 1900 Robson called attention to the frequency of chronic pancreatitis and to the fact that it might simulate, in many of its symptoms, cancer of the head of the pancreas. Since that time more than two hundred cases of chronic pancreatitis and allied conditions have convinced him of the accuracy of his view. On account of the difficulty of diagnosing the condition with the means at hand, Robson and Cammidge originated the test that goes by the latter's name. This he considers of the greatest assistance in diagnosis, not only in the cases of chronic pancreatitis, but also in the cases of chronic pancreatic catarrh. The percentage of unsaponified neutral fat in the feces is also of assistance in the diagnosis.

The so-called chronic catarrhal jaundice is characterized by more or less jaundice, coming on painlessly and associated with digestive disturbances and with some loss of flesh. The liver is usually enlarged and its surface smooth, unless the condition has lasted for a very long period. The gall-bladder may be enlarged if the obstruction to the duct is very great and cholelithiasis has not led to its contraction. If there is intermittent pain it is usually due to some complication, such

¹ Surgery, Gynecology, and Obstetrics, January, 1908, vi, No. 1.

as chronic catarrhal cholecystitis or cholangitis, or to gallstones or duodenal ulcer. If there are chills they are usually dependent upon an associated infective cholangitis. The urine is bile-stained; the feces clay-colored. There is usually great irritation of the skin, which Robson thinks is greater when the jaundice is of pancreatic origin than when it is dependent upon other factors. On palpation, tenderness can usually be elicited about an inch above the umbilicus in the midline, and occasionally, especially if the patient is thin, an elongated tumor may be felt in the same region.

Robson thinks that the catarrhal jaundice so frequently associated with gallstones is by no means the result of the presence of the stones, for in the majority of these cases the stones are present only in the gall-bladder, and could thus not obstruct the duct. His view is that the pancreatitis and the cholelithiasis are the result of a common cause, and that the consequent swelling of the pancreas is the immediate cause of the jaundice. In answer to the question why all cases of stones in the gall-bladder are not associated with jaundice, he states that according to statistics the common duct passes through the head of the pancreas in but 62 per cent. of the cases. In the other 38 per cent. it passes in a groove behind the pancreas, and is consequently not subjected to the compression by the swelling of the inflamed pancreas. The jaundice associated with gastroduodenal catarrh, pneumonia, influenza, and other acute infections may be explained on the same basis. Robson quotes a number of cases in which the passage of a gallstone, or the operative removal of gallstones, did not cause a disappearance of the jaundice. A subsequent cholecystostomy or cholecystenterostomy, however, soon afforded relief from the jaundice, as well as from the other symptoms resulting from the obstruction of the ducts, showing that there was undoubtedly other causes for obstruction than the stones. In operating for gallstones, cholecystenterostomy is the most satisfactory operative procedure; it not only affords a continuous drainage of the ducts, but it relieves the patient of the distress incident to a biliary fistula and leads the bile into the channel where it can participate in digestion. When this cannot be practised, cholecystostomy is preferable to cholecystectomy for the reason that if there should later be a chronic pancreatitis, a cholecystenterostomy can be performed if necessary.

Robson calls attention to the fact that Cammidge has found his test to be present in about two-thirds of the cases of common-duct cholelithiasis that he has examined: and it is in about this proportion of cases in which the common duct passes through the head of the pancreas. It is also the percentage of cases in which Robson has felt an inflammatory swelling of the head of the pancreas. Robson's views regarding the frequency of pancreatitis and its relation to catarrhal jaundice will certainly be accepted with diffidence and especially conclusions that are reached largely on the basis of Cammidge's test.

The Mayo¹ brothers found chronic pancreatitis associated with stone in the common duct in but 18.6 per cent. of their cases. This great variance between the statistics of Robson and the Mayos can be explained only on the basis of the personal equation of the surgeon; the diagnosis is most frequently made on the operating table by the feeling of the enlarged gland. The Mayos have, in addition, made use of the Cammidge test; but, as they mention, this has been found positive much more frequently by its originator than by other observers. In their statistics the Mayos find that 81 per cent. of their cases of chronic pancreatitis were accompanied by gallstones. In 268 operations upon the common and hepatic ducts the pancreas was diseased in 18.6 per cent.; whereas of the cases in which the gall-bladder alone was affected, but 2.45 per cent. showed a coincident pancreatic involvement. The Mayos call attention to a fact that has also been noted by other surgeons, namely, that capillary hemorrhage is more frequent in jaundice associated with pancreatitis than in simple jaundice; and they also quote Robson as stating that the emaciation is more marked and the pigmentation of the skin deeper in cholelithiasis associated with pancreatitis than in uncomplicated cholelithiasis. They also give the preference to cholecystenterostomy as the most advisable operative procedure.

CHRONIC PANCREATITIS AND GLYCOSURIA. Referring to the association of chronic pancreatitis and glycosuria, Robson quotes Opie's work showing that the interlobular form of pancreatitis is seldom associated with glycosuria, and that the interacinar form is frequently found associated with it. This is, of course, in harmony with the view that the islands of Langerhans are the portions of the pancreas especially involved in sugar metabolism, and as they are located in the centre of the lobules they are seldom involved in an interlobular pancreatitis, unless it has advanced to a very extreme degree. Of 65 cases in which biliary calculi were found in the common duct at operation, and in which the pancreas was enlarged and hard, glycosuria was noted but four times. In three of these the amount was under two-tenths of 1 per cent., and in the fourth, four-tenths of 1 per cent. After operation the sugar disappeared from the urine in all but the last case, this patient subsequently dying of diabetic coma. This indicates that a small amount of sugar is no contra-indication to operation.

OPERATIVE RESULTS IN CHRONIC PANCREATITIS. Robson's statistics show a mortality from operation of but a little over 2 per cent. Of the 52 patients who recovered in whom gallstones were found obstructing the pancreatic portion of the common duct, 48 were living and well when last heard of. One was apparently well nine and one-half years subsequent to operation, though sugar has recently been found in the urine. One died of cirrhosis of the liver a year after opera-

¹ New York State Journal of Medicine, 1908, viii, No. 4.

tion; another died of acute bronchitis, and another from some undetermined ailment. Of the 45 patients with interstitial pancreatitis who recovered in whom no gallstones or other removable cause were found, 36 were in good health, 1 developed glycosuria some years after operation, 1 showed continued signs of pancreatitis, 1 developed severe anemia, and no word was received in reply to letters addressed to the remaining 6.

Pancreatic Fistula. The question of the healing of pancreatic fistulæ is of interest to clinicians and surgeons alike. Until the early part of 1907 the healing of a pancreatic fistula was a most difficult and discouraging procedure. In 1907 Wohlgemuth published his method of inducing healing, and reported one case that had been treated with a most gratifying result. Since then this plan of treatment has been employed in 4 additional cases, which are collected by Wohlgemuth.¹ In the case reported by Heineke, a fistula had existed for a number of months after rupture of the pancreas. It became completely healed after three days' treatment by the Wohlgemuth method. Hohemeyer's case was somewhat similar in nature; the fistula had been in existence for six months. It healed after ten days of treatment; it subsequently broke out again, on account of the patient's unwillingness to continue treatment, and was permanently healed after an additional fourteen days of treatment. The 2 remaining cases were reported by Schmidt. The second of these is probably the most striking of all the cases. The patient had had a fistula for a year and a half succeeding an operation for acute hemorrhagic pancreatitis. After fourteen days of the Wohlgemuth treatment, it was completely and permanently healed.

The treatment consists in a strict antidiabetic diet, combined with the administration of large doses of sodium bicarbonate before and after meals. The diet should exclude, as far as possible, all carbohydrate elements. As it is not necessary to continue the treatment for a great length of time, this restricted diet is usually well borne by the patient. From the experience thus far gained, healing should take place within two weeks. Wohlgemuth thinks that six weeks can be looked upon as the limit of administration of his treatment. If the fistula has not healed within this time, it in all probability will not respond to this form of treatment. In addition to the diet 1 dram of sodium bicarbonate is administered one-half hour before each meal, and an equal quantity immediately after each meal.

The principles upon which the treatment is based are derived from the recent animal experimentation on the physiology of digestion.

Wohlgemuth proceeded from the standpoint that the fistula is maintained by the discharge of pancreatic juice, and that reducing this secretion would promote the tendency to healing. Carbohydrates stimulate the flow of pancreatic juice in three ways: psychological, direct,

¹ Berliner klin. Wochenschrift, 1908, Nr. 8, p. 389.

and indirect. The psychical stimulation receives its original impulse by means of the cranial nerves. The direct stimulation is the result of the irritation of nerve fibers, when the carbohydrate reaches the intestinal mucous membrane. The indirect stimulation, probably the most powerful of the three, results from stimulation of pancreatic activity by the acid secreted in the stomach. Fats and proteids, as well as carbohydrates, stimulate the flow of pancreatic juice in the same three ways; but the former two call forth much less of the secretion than do the carbohydrates. The sodium bicarbonate is administered to reduce the acidity of the stomach contents before it passes into the intestines, for hydrochloric acid, acting upon the duodenal mucous membrane, is a powerful stimulant to pancreatic activity.

THE LIVER.

Acute Yellow Atrophy. Several reports on acute yellow atrophy of the liver have appeared during the past year. White¹ reports four typical cases and presents an excellent *resume* of our present knowledge of the subject. Especially worthy of mention are the characteristic *blood pictures* in his cases. In the 4 cases the leukocytes were, respectively, 9000, 12,600, 11,600, and 16,000. The red blood corpuscles, respectively, were 6,640,000, 5,120,000, 6,720,000, and 6,150,000. The hemoglobin in all the cases averaged between 60 and 80 per cent. This relative increase in the erythrocytes is a characteristic feature of both acute yellow atrophy and phosphorus poisoning. The livers in these 4 cases weighed, respectively, 730, 800, 960, and 595 grams. It is interesting that in the 2 cases that lived longest, respectively, fifteen and eleven days, a considerable amount of regeneration was found in the livers. From the standpoint of etiology, only one of the cases presented any very suggestive features. This patient was in the secondary stage of syphilis, a disease of undoubted etiological significance in acute yellow atrophy of the liver.

Reichmann² reports an interesting case of acute yellow atrophy of the liver from the blood of which an unidentified Gram-negative bacillus was isolated in pure culture. On the basis of its cultural peculiarities, its abundant growth on agar, and the negative results attending its injection into rabbits, Reichmann does not believe that this was the cause of the acute yellow atrophy. The patient had an interstitial keratitis and consequently the thought that syphilis might be the cause of the atrophy was entertained. Interstitial keratitis is, however, much more frequently the result of congenital than of acquired syphilis, and con-

¹ Boston Medical and Surgical Journal, 1908, clviii, 729.

² Münchener med. Wochenschrift, 1908, Nr. 18, p. 959.

genital syphilis has not been previously looked upon as the cause of acute yellow atrophy.

Tileston¹ reports 2 cases, one of which is especially interesting in connection with the supposed relationship between *syphilis* and acute yellow atrophy of the liver. The patient was a boy, aged nine years, who had been admitted to the Massachusetts Charitable Eye and Ear Infirmary on account of a double panophthalmitis, resulting from an injury to the left eye. Daily inunctions of mercury were employed for antiphlogistic purposes. These were continued without intermission for nearly two months, when symptoms presented themselves which soon proved to be the early symptoms of acute yellow atrophy of the liver. There was no history of syphilis in the patient. The association of the administration of *mercury* and the acute yellow atrophy leads Tileston to believe that the prolonged use of mercury may have acted as a predisposing factor in the acute liver changes in the case in question, and that mercury may have been of some etiological importance, in conjunction with syphilitic toxins, in many of the reported cases of acute yellow atrophy associated with syphilis.

The interesting feature in the other case reported by Tileston was the presence of *ascites*. He has been able to find but seven other cases in which ascites was associated with an acute yellow atrophy. Schöppler attributes the ascites in these cases to a coincident nephritis, and Marchand to portal obstruction, the result of extensive destruction of liver tissue. A careful consideration of the microscopic features of the liver leads Tileston to the view that the ascites is due in these cases to changes in the circulation within the liver. These changes may be the result of either connective-tissue proliferations or the mechanical effects of the destruction of large amounts of liver tissue. A second point of interest in this case was the extensive dilatation of the duodenum found at the operation that was performed. This dilatation, it is suggested, may, according to the views of Codman, have stood in some etiological relationship to the acute yellow atrophy.

In regard to treatment of acute yellow atrophy of the liver, Reichmann, in the above-mentioned article, calls attention to the fact that the longer these patients have lived after the disease has developed the more regeneration was found in the liver; he suggests that recovery may be favorably influenced if all possible measures are employed to prolong the first stage of the disease before the toxemia has become sufficient to produce death.

Malarial Cirrhosis of the liver is a condition to which sufficient recognition has probably not been given in this country. Its very existence has been denied by some. The frequency of its occurrence naturally depends upon the prevalence of malarial infection in a community. In a

¹ Boston Medical and Surgical Journal, 1908, clviii, 510.

recent article Tucker,¹ who has had the opportunity of observing a great deal of malaria and its consequences in and about Bombay, reports several cases of malarial cirrhosis of the liver and makes some instructive observations on its pathology and symptomatology. He calls attention to the fact that in India the disease is not infrequently found in young children, from whose histories all other causes of the cirrhosis can be eliminated.

The first indications of the disease usually appear after the patient has undergone several attacks of malaria with intermissions of fair health. There is progressive loss of weight and strength, soon followed by abdominal protrusion, the result of the hepatic and splenic enlargements and of the collection of ascitic fluid. The liver in the early stages is usually slightly enlarged and hard, and the surface is finely granular. Later it may become smaller, but the surface remains finely granular, thus differing from the true hob-nailed liver. The spleen is invariably enlarged and at times assumes enormous proportions. There is both perisplenitis and perihepatitis leading to chronic thickening of the peritoneum covering the liver and spleen. This frequently manifests itself clinically by pain and frictions. Occasionally the resulting adhesions form dense bands, which by compression of the stomach lead to various gastric disturbances. The blood undergoes progressive deterioration, ending in a severe degree of secondary anemia.

The patients usually live from one to three years after the development of the disease. Toward the end the emaciation becomes extreme; dyspnea, languor, and edema of the feet appear and the patient goes into coma, which soon ends in death. Tucker is unable to say that one variety of the malarial parasite is more frequently responsible for malarial cirrhosis than is any other. In his own cases he has most frequently found the benign tertian form.

Atrophic Cirrhosis of the Liver. The value of the *Talma-Drummond* operation for cirrhosis of the liver remains a somewhat undecided question. The present status of it is probably well expressed in the following conservative conclusions by Lieblein,² which are based upon his own as well as the recorded cases:

In spite of the gratifying results obtained in isolated cases, the results in general have not fulfilled the hopes that were at first entertained. The effects, however, are not of such a nature as to lead one to discard the operation. The results to be obtained in any case must not be overestimated. Atrophic cirrhosis is a disease that, in not an inconsiderable proportion of cases, can be either cured or, at least, kept for some years in abeyance. Especially in regard to the late results of the operation are statistics very few, and it is possible that our views will change a number

¹ Lancet, May 23, 1908.

² Mitth. a. d. Grenzgeb. d. Med. u. Chir., 1908, xviii, 794.

of times within the years to come. Up to the present time, at least, the results have not been encouraging enough to induce internists to refer their cases for surgical treatment in the very early stages. On the other hand, it would be exceedingly profitable to be able to determine, upon the basis of a large number of cases, how satisfactory the results are when the operation is performed when the disease is in its early stages; and especially as at this time the operation is one of little severity. Not infrequently patients are referred to the surgeons when the general condition has become so bad that, despite the correction of the local defects, little improvement in the patient's state of health can be looked for.

Cholelithiasis. The role that bacteria play in the etiology of cholelithiasis has remained for years a disputed question. That the bile is subject to infection in various pathological states is generally recognized, and there has been more or less of a tendency to look upon gallstones as being directly the result of the agency of bacteria. There are, however, few reliable bacteriological investigations upon which to base this view. The French have been foremost in looking upon gallstones as the result of the influence of microorganisms. Their views are based to a great extent upon the work of Gilbert, who investigated a series of seventy cases of gallstones from the bacteriological standpoint. In a third of the cases he found the stones to contain either living or dead bacteria; in general the more recent stones contained living bacteria, and the older ones dead bacteria. The organism most frequently found was the *Bacillus coli communis*.

With the hope of determining how directly bacteria are responsible for the formation of gallstones, Bacmeister¹ studied a series of 20 cases. The stones were of all varieties, from pure cholesterin stones to soft pigment stones. Of the 20 cases 16 were sterile. Of the remaining 4, 2 contained *Bacillus coli communis* and 2 *Bacillus typhosus*. According to Gilbert's hypothesis, since these four stones contained living organisms, they must have been of recent origin. Instead, however, every indication pointed to the fact that they were old. Later, Bacmeister examined culturally the stones removed from four patients at operation. All were of very recent origin, and all showed themselves to be sterile.

Finally, Bacmeister thoroughly sterilized a number of stones by fractional sterilization, so as to be sure that there were no living bacteria within them. They were then immersed in cultures of bacteria of various sorts. Although the majority remained sterile two of the stones, both of which had been immersed in typhoid bouillon cultures, were found to contain, deep in their substance, living typhoid bacilli.

Subsequently, Bacmeister² published a much more exhaustive study on the pathogenesis of gallstones, especially as to the role played by

¹ Münchener med. Wochenschrift, 1907, Nr. 38, p. 1866.

² Ibid., 1908, Nrs. 4, 5, und 6.

cholesterin in their formation. The chemical substances entering into the formation of gallstones are cholesterin, bile pigments, and lime salts. Of these, the most important and the one whose origin and significance are most discussed is cholesterin. This is a normal constituent of the bile. However, it is in solution and not in the crystalline form in which it is present in gallstones. It was the view of Naunyn and his followers that the cholesterin entering into the formation of gallstones is derived not from the cholesterin in solution in the bile, but from the epithelium of the gall-bladder mucous membrane.

Numerous experiments by other investigators, as well as by Bacmeister, have disproved this theory, and it is now generally accepted that the cholesterin entering into the formation of gallstones is precipitated from the bile itself. One of the most potent factors favoring this precipitation of cholesterin is bacterial growth. This has been shown in vitro by Kramer, Thudichum, and others, as applying especially to the *Bacillus typhosus* and the *Bacillus coli communis*. They attributed this action to the acid-forming property of these organisms. Bacmeister showed that the precipitation of cholesterin is by no means a property of *Bacillus typhosus* and *Bacillus coli communis* alone, but that it is shared by many other microorganisms, and that it is not attributable to the acid-forming properties of the bacterium. He showed, furthermore, that in vitro a precipitation of cholesterin occurred in sterile bile when left to stand for a considerable period. This he observed in filtered as well as in unfiltered bile, and he consequently considers that it could not be the result of the action of the albuminous particles contained in unfiltered bile, although he did not find the rapidity of the process to be increased by their presence. The precipitation of cholesterin and the formation of stones composed of cholesterin, Bacmeister considers to be the result of chemical changes taking place in the bile; and although epithelial particles from the gall-bladder wall are not essential to the process, it is considerably hastened by their presence.

What has been said thus far concerns pure cholesterin stones. It does not apply to stones composed of cholesterin and lime salts, for Bacmeister considers lime salts to be an almost exclusive product of the secreting cells of the gall-bladder. As an amount greater than normal must be furnished to participate in the formation of gallstones, their presence signifies a catarrhal inflammation of the mucous membrane of the gall-bladder.

Exner and Heyrovsky,¹ working in the same field, conducted experiments based on the fact that when a culture medium containing cholesterin and bile acids is inoculated with *Bacillus coli communis* or *Bacillus typhosus*, the cholesterin is precipitated. They found, moreover, that when bile alone is inoculated with *Bacillus typhosus* the bile salts are broken up. Cholesterin, as chemists have known for some time, is

¹ Wiener klin. Wochenschrift, 1907, Nr. 7, p. 213.

soluble in a weak solution of bile salts. Exner and Heyrovsky consequently reasoned that it must be the destruction of the bile salts by bacteria that induces the precipitation of cholesterin. Their experiments consisted in inoculating tubes of bouillon containing bile salts with various bacteria. They found that in a given period of time the typhoid bacillus broke up more bile salts than did any other organism. Next in order came *Bacillus proteus*, and after it *Bacillus coli communis*, *Bacillus Friedlander*, *Staphylococcus aureus*, and *streptococcus*. This finding is in harmony with the frequency with which *Bacillus typhosus* is found associated with gallstones.

On the basis of their experiments, Exner and Heyrovsky conclude that the active element in the production of gallstones is a breaking up of bile acids by bacteria, thus permitting a precipitation of the cholesterin. They conclude, furthermore, that if an organism like the *streptococcus*, which is very inactive in breaking up bile salts, is found in association with gallstones, it may be assumed that its presence is in the nature of a secondary invasion.

Congenital Obliteration of the Bile Ducts. Lavenson¹ reports a case of congenital obliteration of the bile ducts with cirrhosis of the liver, and discusses the pathological and clinical features of this condition based upon his case and 62 additional cases collected from medical literature. The subjects of the disease are deeply jaundiced, either from birth or from a few days later; the stools are clay-colored, and the urine deeply pigmented. Usually the infant remains fairly well-nourished for a time, and the bodily functions are performed in a manner strikingly out of harmony with the severity of the disease. At times hemorrhages from the umbilical cord or from other portions of the body have been noted. The spleen and liver are enlarged, and the surface of the latter can easily be felt as being coarsely granular. Ascites is occasionally present. With rapid loss of weight and strength the infant dies usually before the eighth month. Only 3 cases among the 63 collected lived longer than this time: 2 lived until nine months of age and 1 until eleven months.

The feature of greatest interest in these cases is the cause of the obliteration of the ducts. Rolleston and his followers believe that it is the result of a descending cholangitis caused by the excretion of toxic substances from the liver. Lavenson believes this to be incorrect, and thinks that the primary condition is an obliteration of the ducts, which is in most cases the result of an anomaly of development. On this basis he suggests the term "atresia of the bile ducts" in place of the term "obliteration of the bile ducts." That the condition may be the result of other causes than an anomaly of development is shown by several of the cases collected by Lavenson, and by a case recently reported by Rolleston² of a syphilitic obstruction of the bile ducts in an infant.

¹ Journal of Medical Research, 1908, N. S., No. 1, xiii, 61.

² British Medical Journal, 1907, p. 946.

DISEASES OF THE KIDNEYS.

BY JOHN ROSE BRADFORD, M.D.

Renal Tuberculosis. During the last few years current views with reference to many points in connection with tuberculosis of the kidney have undergone change. Thus, it is recognized that in a very considerable proportion of cases of genito-urinary tuberculosis the renal lesion is in reality the primary one, and this notwithstanding the fact that the early symptoms may have been due to lesions in the lower urinary tract. In other words, the renal lesion, although present, has not given rise to symptoms, and these have merely developed as the result of a secondary infection lower down in the urinary tract and especially in the bladder. Further, in a considerable proportion of cases the renal lesion is not only primary but unilateral, and hence much may be expected from the early diagnosis and correct treatment of the condition. Much assistance has been afforded in the diagnosis of these cases by the modern methods of the bacteriological examination of the urine, and especially the examination of the urine secreted from each kidney and separated by the use of some separator introduced into the bladder. In addition to these many improvements in our knowledge, various observers have drawn attention to the fact that tuberculous processes may give rise to other renal lesions than those characterized by the presence of obvious tuberculous deposits in the organ. Various renal lesions usually described as of the inflammatory type have long been known to be associated with the presence of tuberculous lesions in other parts of the body, more especially phthisis, and nephritis of one or other variety has long been recognized as a possible complication of pulmonary tuberculosis. It would seem probable that both so-called parenchymatous nephritis and chronic interstitial nephritis may be the result of the action of the virus of tubercle on the kidney, and that therefore a tuberculous nephritis may be recognized, although such a kidney does not present obvious naked-eye or microscopic signs of the commonly recognized lesions of tuberculosis.

Albarran¹ discusses the lesions which may be present in the opposite kidney in cases of unilateral renal tuberculosis. The cases to which he draws attention are those in which an ordinary tuberculous kidney on one side presenting the usual fibrocaseous or ulcerative lesions associated with the disease also presents lesions of the opposite kidney which are not obviously and definitely tuberculous. At the present time,

¹ Annales des Maladies Génito-urinaires, 1908, vol. i, No. 2.

and especially by French authors, the following renal lesions have been associated with the presence of tuberculous disease in other parts of the body: (1) Attacks of renal congestion associated with the excretion of considerable numbers of tubercle bacilli in the urine: This condition would seem to be analogous to the so-called pre-tuberculous albuminuria which has been described by Tessier. (2) A simple albuminuria seen in tuberculous patients, an albuminuria that is persistent and may last for many years without the development of any other symptoms. (3) A nephritis indistinguishable from other forms of nephritis and associated with the development of anasarca and a high degree of albuminuria. In some instances this nephritis is accompanied by marked cardiovascular changes, with the development of uremia; in other words, it has a similar clinical picture to that of chronic nephritis dependent on other causes. (4) Waxy kidney, a well-known form of disease which is perhaps not seen quite so frequently now as formerly. (5) The ordinary type of definite tuberculous disease of the kidney, associated with the greater or less development of tuberculous deposits in the organ.

All these forms of renal lesion may be seen from time to time in cases of pulmonary or other forms of tuberculosis. Albarran draws attention to the fact that these various renal lesions may not only be seen in association with tuberculous disease in other regions of the body, but may also be present in the kidney of the side opposite to unilateral definite renal tuberculosis. He considers that in unilateral renal tuberculosis the opposite kidney frequently presents lesions which are not definitely of the tuberculous type, and that in the majority of cases they fall into one of two groups, the first consisting of those characterized by a simple albuminuria, and the second where there is a nephritis accompanied by dropsy; the latter affection is far less frequently observed than the former. In addition to these two definite varieties, others of a less definite type may be recognized, and that one is characterized by a hemorrhagic tendency, and that in another the main phenomenon is an extensive desquamation of the renal epithelium.

In the cases characterized by simple albuminuria the urine presents the following characteristics: In quantity it may be approximately normal or slightly above the normal; it is rare for the daily output of urine to be doubled. The output of urea varies between 12 and 20 grams in the twenty-four hours, and the quantity may be even greater than this in cases where the renal lesions are serious. The albuminuria is fairly constant and moderate in amount, although there may be variations from day to day in the amount passed. In a small proportion of cases the albuminuria is not only very slight, but it may disappear even for weeks or months, reappearing again later. The urine will necessarily contain pus derived from the affected kidney, but it is rare for casts to be present, and when present they are usually of a hyaline or granular type. If the urine secreted by the two kidneys be separated, that derived

from the tuberculous kidney is generally constantly albuminous. According to Albarran, even when the lesions are very extensive the urine may not contain more than 1 to 2 grams of albumin per liter. In a large proportion of cases the urine derived from the opposite kidney may be free from albumin, but it is not uncommon to find traces amounting to 10 or 15 cg. per liter, and he has observed a considerable number of cases where there was as much as from 25 to 50 cg. per liter, and in two cases as much as 1 gram. That is to say, quantities of albumin quite comparable to those present in the urine secreted from the tuberculous organ itself.

On microscopic examination the urine derived from the tuberculous kidney usually contains pus in greater or less quantity, and often blood corpuscles and epithelial cells; it is exceptional, however, to find casts. The urine derived from the opposite kidney, however, often contains no formed elements, a few white blood corpuscles may be found, sometimes a few hyaline or granular casts. As regards the quantity of urine secreted by the two kidneys, Albarran made observations on 45 cases, and found that in 26 there was polyuria on the sound side, and in 14 cases there was polyuria on the affected side. In 3 cases the quantities excreted from the two kidneys were equal, and in 2 the results were uncertain. Polyuria on the side of the tuberculous kidney is especially liable to be present when the lesions are slight, and it is rare for this increased excretion to be present when multiple caseous and breaking down foci are present.

When the tuberculous disease is advanced the quantity of urine, secreted from the affected kidney may be very small. Albarran sums up the results by stating that the urine derived from the kidney on the side opposite to that affected by the tuberculous disease often shows a distinct increase in amount associated with albuminuria, together with the presence of some casts. If the tuberculous kidney be successfully removed the albuminuria frequently disappears in from a fortnight to from two to three months after the operation, provided it has been slight in amount and not accompanied by casts. In some instances, however, even when the albuminuria is slight, it may persist for months or even for years after the operation. Where the albuminuria has been considerable in amount it frequently persists, notwithstanding that the quantity of urine excreted remains normal; in other instances the albuminuria is accompanied by an increase in the daily excretion of urine, and in some of these cases the elimination of the kidney as tested by methylene blue and phloridzin may show signs of impairment. They do not, however, develop the ordinary signs of Bright's disease, such as anasarca and cardiovascular degeneration, but the albuminuria is likely to be increased by the upright posture and also by the occurrence of acute infections, such as influenza, etc. Albarran seems to be of opinion that these patients may in the course of time develop more serious nephritis. In 3 instances

this author has seen unilateral renal tuberculosis accompanied by the development of a parenchymatous nephritis of the opposite kidney, but in one of these the nephritis was really double. He further draws attention to the very interesting observation that a non-tuberculous surgical lesion of one kidney may be associated with the development of parenchymatous nephritis of the opposite kidney, and he mentions a pyonephrosis on the right side where nephritis developed in the opposite kidney, accompanied by dropsy and the usual picture of Bright's disease, and another where a renal calculus associated with atrophy of the kidney was complicated by the development of a large white kidney on the opposite side.

In addition to the various lesions already described as associated with cases of renal tuberculosis, Albarran discusses the significance of *hematuria* in these conditions. Hematuria considerable in amount is not uncommonly seen in this disease, and has usually been associated directly with the tuberculous, and especially with the ulcerative, lesions present. Albarran considers that in many cases the hematuria is not directly dependent on the tuberculous lesion itself, but is rather due to a concomitant nephritis, and he records instances of tuberculous kidneys where abundant hematuria has been a marked clinical symptom and yet where the tuberculous lesions were slight in amount. Further, the examination of the kidneys often shows that the hemorrhage is derived from a part of the kidney at some distance from any tuberculous deposit. Again, a hemorrhagic nephritis may be present in tuberculous patients without there being any tuberculous lesion of the kidney; and he records an instance of a case of tuberculosis where a hematuria derived from the left kidney persisted for some two months and where the urine contained no pus and no bacilli. In these instances the examination of the kidney showed that the hemorrhage was due to nephritis without any renal tuberculosis; he also records instances where hematuria has occurred from a kidney on the opposite side to that affected by tubercle; and lastly, one instance where hematuria occurred subsequently to the removal of the opposite kidney for tuberculous disease, and yet where subsequently to the operation the patient lived for many years without developing any signs or symptoms of renal tuberculosis.

Albarran further describes a lesion, to which he gives the name of *desquamative nephritis*, which also may exist on the side opposite to that affected by unilateral renal tuberculosis. In one such case the removal by nephrectomy of the tuberculous kidney was followed by death from anuria, notwithstanding the fact that the urine prior to the operation secreted by the non-tuberculous kidney was free from albumin, and only contained large quantities of renal cells and numerous granular casts.

Albarran concludes from his own observations that in cases of unilateral renal tuberculosis lesions of the opposite kidney of the following

varieties may be present: (1) A slight albuminuria accompanied by an increase in the excretion of urine present before the operation may diminish and subsequently disappear entirely, the kidney apparently regaining its normal function. (2) A similar albuminuria may persist for several years and may undergo exacerbation as the result of trivial causes. (3) Diffuse nephritis of the usual type and very possibly accompanied by dropsy. (4) A hemorrhagic nephritis. (5) Lastly, a condition of desquamative nephritis apparently unaccompanied by albuminuria. From a clinical standpoint it is essential to make a differential diagnosis between such lesions and bilateral tuberculous disease. This can usually be effected by a careful examination of the urine, and especially by the absence of pus and the tubercle bacilli. It is more difficult to make a differential diagnosis between the different forms of nephritis just described, and stress must be laid specially on the presence or absence of dropsy and by the evidence of the impairment of the permeability of the kidney to methylene blue and the phloridzin test.

It is possible that some of these lesions may owe their origin to the absorption of toxins or cytotoxins from the tuberculous kidney, and hence the secretion of an albuminous urine may not be a contra-indication to operation in cases of unilateral renal tuberculosis, since in a considerable number of cases the albuminuria clears up subsequently to the nephrectomy. An abundant albuminuria accompanied, however, with the excretion of a considerable number of casts, together with polyuria, must be regarded as a contra-indication, inasmuch as all these factors imply that the efficiency of the kidney is very seriously compromised.

Loumeau¹ describes a rather remarkable case of unilateral renal tuberculosis where the lesions were especially epithelial and interstitial, and where the overgrowth of fibrous tissue had been so considerable as to produce a small atrophied organ. The obvious tuberculous lesion consisted of a small deposit no larger than a pea; the rest of the organ presented all the usual appearances associated with what is known as the granular kidney. The patient had formerly suffered from phthisis with hemoptysis, but during the last four years the pulmonary lesions had become quiescent, and the patient sought advice on account of attacks of very severe pain in the right lumbar region presenting considerable resemblance to attacks of renal colic. Advice was sought on account of the severity of these abdominal seizures, and examination of the urine revealed the presence of tubercle bacilli and of leukocytes. On cystoscopic examination and by separation of the urines of the two kidneys it was ascertained that scarcely any urine was secreted by the right kidney. For this reason, and owing to the severity of the attacks of pain, nephrectomy was performed with complete success.

¹ *Annales des Maladies Génito-urinaires*, 1908, vol. i, No. 13.

The main interest of this case from the clinical standpoint rests on the fact that a fibrous kidney, the result of tuberculous lesion, is capable of giving rise to severe attacks of pain similar to those seen in calculous disease. Loumeau draws attention to the occurrence of severe renal pain in cases of fibrosis of the renal capsule, and thinks that the expression used by Reginald Harrison of renal glaucoma may be applied to such cases; he is also of opinion that this type of case forms a definite variety of atrophic or fibrous variety of tuberculous kidney. Such a case also affords an instance of one method by means of which renal tuberculosis may undergo in rare instances spontaneous cure.

Rafin¹ records results of *lumbar nephrectomy* in cases of renal tuberculosis. His cases are limited to those where the nephrectomy has been undertaken as the primary operation. Among 63 cases, death occurred as the result of the operation in 7, giving a percentage of 11. The principal causes leading to death were the results of lesions of the opposite kidney or the presence of pulmonary tuberculosis; in some instances death occurred as the result of infection or from the prostration and cachexia induced by the disease. In 5 out of the 7 cases in which death occurred tuberculous lesions were found in the opposite kidney, and in one of these the nephrectomy was followed by anuria, death occurring on the twelfth day, the second kidney being entirely destroyed by caseous deposits. In one case acute miliary tuberculosis was present, and in two others pulmonary lesions were present; in one instance death occurred as the result of infection, and a pulmonary infarct was present. In one case death resulted from cachexia, and the second kidney revealed very few tuberculous lesions.

Rafin draws attention to the frequency with which lesions of the second kidney were present, and the question presents itself as to whether the present methods of determining the integrity of the second kidney give incorrect results. In the 7 fatal cases catheterization of the ureter gave accurate results in 3 cases, as confirmed by the postmortem examination. In one case misleading results were obtained, and in the remaining 3 cases the lesions present in the bladder were so pronounced that all endeavors to collect the urine separately from the two kidneys failed. Rafin considers that it is probable that with better technical methods, the result of larger experience, the diagnosis of bilateral disease should have been made in these three cases and operation refused. In some instances it may be advisable for an exploratory incision to be made on the opposite side, in order to determine with certainty whether the kidney supposed to be healthy is so really. In 52 cases catheterization of the ureters was carried out, and the mortality of nephrectomy in this series was but 7.6 per cent., and Rafin considers that the most important determining factor in the success of nephrectomy for tuberculous disease is a correct diagnosis as to the efficiency of the second kidney.

¹ Lyon Médicale, January, 1908, vol. cx, No. 2.

He considers the three following conditions necessary for success: (1) Never to operate without having ascertained the state of efficiency of the second kidney; (2) to determine the functional activity of the kidney at the earliest stage possible, and certainly so soon as any vesical symptoms present themselves and before any tuberculous lesions in the bladder have so deformed the organ as to prevent the efficient separation of the urine from the opposite kidneys by the use of a separator; and (3) lastly, to perform the operation at a time when the patient's general condition is good.

Syphilitic Nephritis. Fiessinger¹ discusses the different forms of albuminuria that may result from syphilitic infection, and the treatment of these conditions. Syphilis is now recognized as a not uncommon cause of nephritis and albuminuria, and in many instances the relation of syphilis to the renal disease is liable to be overlooked, inasmuch as the nephritis may present clinical symptoms very similar to those seen in nephritis dependent on other causes. Syphilitic albuminuria is especially apt to manifest itself during the secondary stage of syphilitic infection, but it may also occur during the tertiary period. The first variety is especially apt to develop in the early stages of syphilitic infection, especially in the third or fourth month, at a time when other secondary manifestations are liable to be present. The renal complication very often simulates in its origin an attack of nephritis attributed to cold, and it is by no means easy always to detect its syphilitic origin. In this variety of syphilitic nephritis the symptoms and signs are in many respects similar to those seen in other varieties of the affection: thus, edema may be present or absent and there may be great variations in the degree to which the quantity of urine is diminished, but there is one characteristic of syphilitic nephritis that tends to separate it from most other forms, and that is the large quantity of albumin. Not only is there a large percentage amount of albumin, so that the urine on boiling may become absolutely solid, but the quantity lost in the twenty-four hours may be very considerable owing to the fact that the volume of urine excreted may not be greatly diminished. As much as 30 to 50 grams of albumin may be passed in the twenty-four hours, and there is a case recorded by Fournier and Brouardel where as much as 110 grams of albumin were passed in the twenty-four hours. In many instances large quantities of albumin form not only the most characteristic feature of the illness, but almost the only one, anasarca and other symptoms of renal disease being absent. This, however, is by no means always the case, and instances are known where the course of the disease has been rapid, marked dyspnea, diarrhea and vomiting, and other uremic symptoms being present. Death has also been known to occur as the result of the development of cardiac dilatation. In other cases the disease be-

¹ Journal des Praticiens, August 3, 1907.

comes chronic, and in not a few recovery takes place with the complete disappearance of all the symptoms.

According to Fiessinger some of the slighter forms of the affection may undergo recovery without any specific treatment, and in others of a more severe type such treatment may be absolutely unavailing. Fiessinger considers that there are certain types of the disease in which mercury is powerless, and these are especially the very severe and the very slight cases. In the very severe cases death occurs after a few weeks of illness with marked gastro-intestinal symptoms, and the author thinks that mercurial treatment only aggravates these cases. In these severe cases, and especially in those associated with edema, necrotic lesions of the renal epithelium are probably present, and it is for this reason that mercury is held to be contra-indicated. Further, it is possible that the administration of mercury in the treatment of secondary syphilis, where no renal complication is present, may sometimes be accompanied by the development of albuminuria and slight dropsy. In these cases it is probably safer to leave off the mercurial administration for a time and to put the patient to bed on a milk diet.

Mercury has been known to produce nephritis in cases where it has been administered in the treatment of non-syphilitic lesions, and it would certainly seem that some people are extremely susceptible to its toxic action on the renal elements. The variety of syphilitic nephritis in which mercury is especially useful is that in which the disease is of moderate severity, and here the great practical difficulty is generally to decide whether or not the nephritis is of specific origin. The drug is of most use in the cases where albuminuria is not only the only symptom of the renal lesion, but especially where, as already mentioned, the albuminuria is excessive in amount. Thus there is a case recorded by Le Gendre where a daily output of 99 grams of albumin was present and where mercurial treatment associated with iodide of potassium was completely successful. These cases form a very definite group, and can usually be recognized, owing to the contrast between the degree of albuminuria present and the absence of other marked symptoms. Although mercury is very useful in these cases, convalescence is very frequently prolonged and the albuminuria does not clear up for many months, sometimes as many as six or eight. In a small proportion of cases the albuminuria disappears in the course of six weeks to two months. Probably the most useful practical rule in cases where there is doubt as to the nature of the nephritis present is to treat the case first of all on the general principles of rest and low diet. If in the course of a week the albuminuria undergoes no diminution, a trial may be made of the effect of mercury. If this increases the albuminuria the treatment should be stopped. On the other hand, it should be persisted in if the albuminuria undergoes diminution or even if it remain stationary in amount.

The *albuminuria of tertiary syphilis* is also somewhat difficult to treat especially as in many of these cases interstitial nephritis with considerable fibroid overgrowth may be present, and this is usually looked upon as a contra-indication to the use of mercury. There can be little doubt that in such cases mercury can only aggravate the renal lesion. In cases of albuminuria associated with other manifestations of tertiary syphilis, especially arterial disease and high tension, mercury aggravates the condition, and, as Fiessinger points out, the renal lesion in this case is really to be looked upon rather as a parasyphilitic affection than as a true syphilitic one.

Fiessinger is of opinion that there is one form of tertiary syphilitic renal lesion that may be recognized—a form in which in addition to the signs of renal lesion the liver is large and painful and ascites and jaundice are not uncommonly present. If such a patient does not present any signs of arterial high tension, Fiessinger considers that mercurial treatment is useful. Further, there are other cases where a patient may present signs of tertiary syphilis, such as some variety of ophthalmoplegia associated, it may be, with the general anasarca and considerable albuminuria. In many of these cases the renal lesion will undergo improvement with mercurial treatment when no such improvement has followed the ordinary routine treatment, such as low diet, rest, etc. Thus in tertiary cases the same line of practice should be followed as in the cases where nephritis occurs during the secondary stage: a trial should first be made with the ordinary treatment, and then mercury may be prescribed, provided there are no marked signs of high tension or of cardiovascular degeneration associated with interstitial nephritis.

Hemorrhage in Renal Disease. Hemorrhage occurs as a complication in many different situations in Bright's disease, and in some instances the hemorrhage can be directly correlated with the vascular lesions that are so often associated with renal lesions. Even in the instances where this is the case it would, however, often seem that the hemorrhagic cases belong to a distinct clinical group; this is perhaps more especially true of cases of cerebral hemorrhage and of retinal hemorrhage. In the latter, although no doubt the kidneys are often affected with a certain degree of interstitial nephritis, yet the main lesions are those characteristic of widespread arterial degeneration. Further, very often the retinal hemorrhage is the first symptom that attracts attention, and although examination reveals the underlying kidney disease, yet the prognosis is more often perhaps dependent on the state of the vessels generally, and especially the cerebral vessels, than directly on the renal lesion. In other words, these patients very often develop and succumb to such complications as cerebral hemorrhage or to the effects of the arterial lesions on the heart rather than to the direct results of the kidney disease itself, such as uremia.

Most writers, and especially Huchard, have regarded cerebral hemor-

rhage and retinal hemorrhage as especially associated with vascular degeneration and high tension, but Riesman¹ quotes Schoenemann as stating that epistaxis, which is so often associated with renal disease, is dependent rather on lesions of the capillaries than on gross changes in the larger vessels. He states that the number of peripheral capillaries in the nasal mucous membrane is greatly increased and that the capillary loops frequently force their way through the deeper layers of the epithelial cells, and that then the capillary walls undergo rupture and hence lead to the epistaxis. According to Schoenemann these lesions in the nasal mucous membrane are especially associated with nephritis, and they cannot be attributed to mere mechanical effects such as obstruction of the circulation. Further, the deeper vessels show no change, and thus he is led to conclude that the changes in the capillary walls and the subsequent hemorrhage are dependent on the direct action on the vessel wall of some substance circulating in the blood. This is rather a return to an old view of Rayer, who considered that an alteration in the blood was frequently the cause of the occurrence of hemorrhage in renal disease.

Riesman in his paper deals with the various forms of hemorrhage which may be associated with renal disease. Thus *cerebral hemorrhage*, *epistaxis*, and *retinal hemorrhage* are by no means the only forms of hemorrhage which are known to occur in association with nephritis. A number of writers have drawn attention to the occurrence of *metrorrhagia*, and Riesman records a number of cases mentioned by older writers, such as Grainger Stewart, Lecorché, etc.; and in some instances death has occurred from the severity of the hemorrhage apparently dependent on or, at any rate, associated with renal disease. In most instances these cases have occurred in association with interstitial nephritis and in patients of middle age, but instances are known where this complication has been present in young patients.

Hemoptysis is a rare complication of renal disease, but here also it has usually been found in association with cirrhosis of the kidney, and it has been attributed to arterial sclerosis of the pulmonary arteries dependent on the high tension and the associated cardiovascular lesions. It is possible that in some of these cases of extensive cardiovascular degeneration the renal lesion is really the result of the widespread arterial change, or perhaps that they are both the result of a common cause. It is difficult to regard the arterial lesions as merely consecutive to the renal disease, since the latter is very often much less advanced than the former.

Hematemesis has also been regarded in a few instances as associated with small white contracted kidneys. All these three last forms of hemorrhage are, however, rare, and *hematuria* is a very much more common form. Doubtless in some instances this is an indication of

¹ American Journal of the Medical Sciences, November, 1907.

the development of acute nephritis, or at any rate of an acute exacerbation of a chronic disease; but this is not always the case, and sometimes, as recorded by a number of observers, profuse renal hemorrhage is apparently associated with great engorgement of the vessels of the renal pelvis and the hemorrhage is not derived from the kidney substance at all.

Riesman quotes Schwartz as having recorded a case of *hemorrhage into the ear*, and a number of similar cases have been reported by Haug. Riesman draws attention to the fact that hemorrhage into the tympanic cavity may occur apparently at an early stage of nephritis.

In addition to all these forms of hemorrhage more or less associated with renal disease, there are a few recorded instances where Bright's disease has been associated with *purpura*, and in some instances the purpura has been of a sufficient degree of severity to be entitled *purpura hemorrhagica*; in other words, hemorrhagic diathesis has been present.

The relation of nephritis to *purpura hemorrhagica* would seem to be somewhat complex, since, although usually, the purpura hemorrhagica occurs as a complication of the underlying renal disease, yet in some instances nephritis of a severe type has been known to develop as a complication of purpura hemorrhagica. Both Wagner and Senator have described the hemorrhagic diathesis as preceding and as a cause of nephritis in some instances, and I have myself seen a case where severe purpura hemorrhagica occurred in an apparently healthy lad and where subsequently during the subsidence of the purpura a severe nephritis ensued which persisted and became chronic.

Riesman draws attention to a case reported by Johnson where the suggestion was made that both the purpura and the renal disease might perhaps be due to the same cause, inasmuch as the urinary changes occurred almost simultaneously with the purpura. Gee has also recorded instances of the association of purpura, at any rate in children, with nephritis, and here also it would seem that both the purpura and the renal lesions were in all probability dependent on the action of one and the same toxic agent. Riesman himself records two cases, aged respectively thirty and thirty-five years, both of them fatal, where the hemorrhagic diathesis was associated with nephritis.

In discussing the whole subject, Riesman considers that the association of purpura with nephritis may be due to one or more of the following conditions: (1) That purpura may be an independent affection not causally related to the nephritis. The example he quotes is such a condition as ulcerative endocarditis co-existing with renal disease and giving rise to purpura. (2) Purpura may apparently be the cause of the nephritis. (3) The purpura and the nephritis may be due to the same cause. It is difficult to separate two from three. Lastly, (4) purpura even of the hemorrhagic type may occur as a complication of chronic renal disease.

Although high tension and arterial lesions are capable of causing many forms of hemorrhage associated with renal disease, yet they can scarcely be held answerable for the development of true purpura, and it would seem that this must be dependent on a toxemia. A number of hemolysins are known, and it would seem that a body of this nature must be the essential factor in this class of cases.

Riesman sums up by stating that Bright's disease may be the cause of nasal, uterine, pulmonary, gastric, cerebral, and retinal hemorrhage, and that in addition in a few instances purpura hemorrhagica may result, leading to bleeding from the mucous surfaces and also from the skin.

Where purpura occurs as a complication of chronic renal disease the prognosis is generally hopeless, but this is by no means the case where it precedes or accompanies the renal lesion. In my opinion, where nephritis is seen to follow an attack of purpura hemorrhagica it is possible that the cause of the nephritis is sometimes the treatment that has been adopted whilst the purpura was present. Thus a case has fallen under my observation where severe nephritis occurred subsequently to an attack of purpura hemorrhagica, and there was reason to believe that the cause of the nephritis was really the large doses of turpentine that had been ordered to check the hemorrhagic diathesis. It is, however, possible that nephritis may arise as a result of the action of cell toxins and hemolysins, since there is not that differentiation in the action of cell toxins that was at one time thought. Thus an hemolysin may have a nephrotoxic action just as a nephrotoxin may have a hemolytic action, and hence it is not unreasonable to suppose that a cell toxin may be quite capable of giving rise both to purpura and to nephritis.

Etiology of Chronic Nephritis. Haven Emerson¹ deals with the subject mainly from an experimental standpoint. He draws attention to the great increase which has occurred during the last twenty-five years in the death rate from kidney disease. This has been noticed not only in the large cities of America, such as Boston, New York, and Chicago, but also in the Registrar-General's Statistics in London. It is difficult to think that the whole of this increase is simply dependent on improved methods of diagnosis and more accurate records of mortality statistics, but as yet no sufficient explanation of the cause of the increase nor of the widespread occurrence of nephritis has been put forward.

The study of the etiology of nephritis by experimental methods has undoubtedly shown that the condition can be produced by a very large number of toxic substances both mineral and vegetable, and in addition to these, toxins of pathogenic bacteria and a number of cell toxins, derived not only from the kidney cells but also from other tissues, are also effective agents in producing nephritis. Many of these toxic substances

¹ Archives of Internal Medicine, June, 1908.

produce lesions in experimental animals very similar, indeed, to those seen in the human subject as the result of disease, and further, nephritis occurs not infrequently both in domestic animals and in wild animals kept in a state of captivity.

Although the part played by toxic substances in the production of nephritis is a very great one, yet the question arises as to whether that is the sole cause of the production of nephritis, especially in some of its chronic forms. Other factors have to be taken into consideration, and one of the most important is the effect produced by circulatory disturbance and especially perhaps by long-continued passive congestion of the kidney. Emerson's observations were directed more especially to elucidating the part played by variations in the blood supply and more especially by the effects produced as a result of stagnation of venous blood or a diminution in the arterial supply.

It is difficult experimentally to produce changes in the blood supply of the kidney, as most of the effects produced by drugs are so transitory. Emerson used alcohol, ether, chloroform, and amyl nitrate to see whether the action of general vasodilators would be followed by any appreciable change in the structure and function of the kidney. He finds that the inhalation of alcohol tends to produce a chronic degeneration of the kidney, with a slight increase in the amount of connective tissue. To produce this effect alcohol was administered by inhalation in doses of from 25 to 60 c.c. during a period extending over six months at intervals of a few days. The capsule of the kidney in such instances was considerably increased in thickness, the glomerular tufts were distended, and the cells increased in number. The tubules of the kidney were extensively degenerated, so that scarcely any normal tubules were to be found, and there were small areas of round-cell connective tissue in the cortical layer. The inhalation of ether and of chloroform also caused changes in the glomerular and tubular cells, with some signs of degeneration, and amyl nitrate, in addition to causing marked visceral engorgement, also produced a moderate degeneration of the tubular epithelium and some connective-tissue formation.

Emerson interprets the results by looking upon the degenerative changes as the result of the repeated disturbance of the circulation in the kidney which these drugs produced. He holds this opinion inasmuch as the animals experimented upon survived the prolonged administration of these drugs by inhalation, and their nutrition remained good and they even gained in weight, at any rate for a time; any symptoms of failure of nutrition that occurred were tardy in their appearance. For these reasons he does not think that the drugs caused acute degenerative changes at the time of their administration, but that rather the chronic nephritis observed was the result of the repeated vascular disturbance.

Although a very large number of toxic substances capable of causing nephritis have been experimented on in the laboratory, the only one that

is of any great practical importance from the point of view of human pathology is *lead* and its salts. This is known to produce chronic nephritis both in man and in animals, but in many of the other instances of the action of such substances as aloin, cantharidin, chlorate and bichromate of potash, arsenic, oxalic acid, etc., the results produced are often temporary and do not lead to the production of a progressive chronic nephritis. The use of mercury experimentally not uncommonly leads to the death of animals by the production of acute renal lesions, but here also it is difficult, if not impossible, to produce a chronic progressive nephritis by the administration of the drug in small doses for prolonged periods.

A number of the organic poisons, such as the toxins produced by micro-organisms and nephrotoxic serum, produce also rather acute lesions of varying degrees of severity than chronic and progressive effects.

There is undoubtedly far more difficulty in explaining the etiology of chronic progressive lesions in man than to account for the more acute and transitory effects seen as the result either of poisoning or as a sequel of acute infective processes. This difficulty may perhaps be met to some extent by supposing that in the case of the chronic lesions there is some other factor besides the mere action of a toxic substance, and disturbances of the circulation may perhaps be this accessory factor.

Emerson classifies the etiology of chronic nephritis in man under four headings: (1) Infective processes, such as scarlet fever, diphtheria, pneumonia, typhoid, tuberculosis, septicemia, and erysipelas. (2) The poisons of gout, rheumatism, syphilis, and lead; in the case of syphilis there does not seem any valid reason in my opinion for separating this form of nephritis from that due to acute infection, inasmuch as nephritis is frequently seen as an early complication of recent syphilis. (3) The excessive use of stimulating foods and drinks; this form of nephritis is essentially of toxic origin. (4) As a sequel to disturbance of the circulation, as in the case of cardiac disease and after exposure to wet and cold and muscular fatigue, and possibly as a sequel to mental worry and anxiety.

In all these conditions disturbances of the circulation are liable to occur, and there is much evidence to show that prolonged exertion may lead to congestion of the kidney with development of albuminuria. It is possible that as a result of a large meat diet the viscosity of the blood may be increased and in that way the circulation hampered. The main conclusion to be derived from Emerson's critical and experimental study of the subject would seem to be that, at any rate in chronic nephritis, a vascular factor may play a part of some importance, although it is difficult to believe that the vascular disturbance itself apart from the action of any toxic agent on the renal structures is the sole cause of chronic nephritis, but it may well be that vascular disturbance produced in any of the ways mentioned may turn the scale in favor of the production of chronic nephritis as a result of the action of toxins circulating in the blood stream.

Bacilluria. During the last twenty-five years there have been very considerable additions to our knowledge of the part played by urinary infections in the production of disease. It is now recognized that severe symptoms of illness may be produced by a number of infections of the urinary tract which do not give rise necessarily to marked physical signs or even in some instances to marked symptoms directing attention to the urinary tract. A number of these conditions are now grouped under the general term of *bacilluria*, a term which has replaced that of *bacteriuria* given to the condition by Sir William Roberts in 1881.

In a considerable proportion of cases the presence of organisms in the urine gives rise to obvious indications in the urinary tract, such as pyelitis, pyelonephritis, cystitis, prostatitis, but in not a few the coarse signs of inflammation are absent and the condition may be almost overlooked unless a bacteriological examination be made. Still, the mere presence of bacilli in the urine does not necessarily give rise to pathological effects, and it is now well recognized that virulent pathogenic organisms, *e. g.*, the typhoid bacillus and possibly the tubercle bacillus, may be excreted in the urine for considerable periods without giving rise to any obvious ill effects. This excretion of virulent organisms, however, may not be without importance from a public health point of view, as individuals excreting such organisms and acting therefore as carriers may be a source of danger to the community. Further, the absence of symptoms in a number of these conditions may be dependent on an acquired immunity on the part of the patient.

There is, however, another group of cases where, notwithstanding the fact that no marked symptoms are produced and the health of the individual seems to be normal, yet the examination of the urine reveals some morbid products, as, for example, small quantities of pus or a trace of albumin. Not uncommonly conditions of this kind are discovered more or less accidentally as the result of the routine examination of the urine for life insurance or some similar purpose.

There is yet another class of cases in which the patient's attention is directed to the urine owing to its peculiar smell, which has often been described as fish-like, and dependent on the formation of various substances as the result of the presence of bacilluria and especially of the colon bacillus in the urine.

In a still larger group of cases definite symptoms of inflammation of some portion of the urinary tract, more especially cystitis, are present; and lastly, in other instances still more severe effects are produced as a result of the presence of pyelonephritis; pyonephrosis would also seem sometimes to develop as the result of bacilluria.

A considerable number of organisms have been found in bacilluria, but the *colon bacillus* is one of the most important and the one most frequently present. Faltin¹ states that from 42 to 43 per cent. of cases

¹ Quoted by Batty Shaw, *Clinical Journal*, February 12, 1908.

of bacilluria are dependent on the presence of some variety of the colon bacillus, and staphylococcal infections are present in 25 per cent. and streptococcal in 20 per cent. Other organisms more rarely found are the *Bacillus pyocyaneus* and the *proteus bacillus*. Other observers have obtained very similar results, and there is a general consensus of opinion that while *Bacillus coli* or some organism closely allied to it is frequently present, yet *staphylococci* and *streptococci* are more likely to give rise to serious results, and the graver affections of the urinary tract are more frequently due to these either alone or in association with the colon bacillus.

As already stated, the presence of the *Bacillus coli* in the urine may give rise to no symptoms, and yet, as the result of some comparatively trivial cause, severe effects may subsequently develop, as, for example, in cases where, owing to some impediment to the exit of urine, the detrusor action of the bladder becomes impaired, or in cases where an infection is apparently set up subsequent to the passage of an instrument into the bladder.

Coli bacilluria is of interest not only from its frequency, but also from the problems concerned with its gaining access to the urinary tract. Bacilluria as a whole may be dependent either on ascending or descending infections of the urinary channels, and there is still some difference of opinion as to the relative frequency of these two methods of infection. The colon bacillus has been found in the urethra by Melchior in some 50 per cent. of all cases examined (Batty Shaw), and this organism has been found in a number of instances where catheters have never been used. It has been supposed that the organism ascends the urethra, and it would certainly seem that this is not an uncommon occurrence in women where cystitis dependent on colon bacillus is far more frequent than in men. It is, however, improbable that all cases of colon bacillus cystitis are dependent on an ascending infection.

It is now well recognized that bacilli that have gained access to the general circulation are frequently excreted in the urine, and Lockwood,¹ in a clinical lecture on *colon bacillus cystitis*, draws attention to the frequency with which patients suffering from colon bacillus cystitis have suffered from some antecedent illness which may well be due to a bacillary infection of some kind, although often called influenza. Trumpp (quoted by Batty Shaw) has drawn attention to the occurrence of *coli bacilluria in children* as a sequel of follicular enteritis, and some authors have gone so far as to suppose that colon bacilli may reach the blood simply as the result of long-continued constipation. Lockwood draws attention to the occurrence of colon bacillus cystitis after operations on the rectum and the possibility that under such circumstances the bacillus passes into the circulation and is subsequently excreted by

¹ Clinical Journal, November 13, 1907.

the urine. In these cases of descending infection the occurrence of cystitis is much more likely to take place when there is some impediment to the emptying of the bladder, either as the result of stricture or enlargement of the prostate, and in the case of women it is not uncommon for some difficulty to be experienced in emptying the bladder, notwithstanding the absence of any gross mechanical obstruction.

Lockwood draws attention to the frequency with which tenderness of the prostrate is present in this form of cystitis, although the formation of prostatic abscess has not been observed by him. Inflammation may also affect the vesiculæ seminales, the spermatic cord, and every now and then orchitis may occur as a complication. He draws attention to the confusion that may exist between a case of acute colon bacillus cystitis and an attack of peritonitis dependent on appendicitis when the appendix is situated in the pelvis. Patients suffering from a severe attack of colon bacillus cystitis may develop a considerable degree of abdominal distention. The examination of the urine will usually reveal the nature of the case, but not uncommonly the quantity of pus present is so small that it can only be observed on microscopic examination, but large quantities of motile, oval-ended coli bacilli may be seen. The most dangerous complication with colon bacillus cystitis is the development of ascending pyelonephritis, and the symptoms associated with this may lead to the erroneous diagnosis of renal calculus. In cases of pyelonephritis it is of importance to ascertain the functional activity of each kidney by the use of Luy's separator, as otherwise serious errors may be made. Thus, Lockwood quotes a case where the symptoms suggested suppuration of the left kidney, whereas the use of the separator showed that the suppuration had ceased on the left side and that the pus was really derived from the right kidney.

Lockwood also draws attention to the fact that colon bacillus cystitis may sometimes develop after an injury to the genito-urinary tract, and he quotes a case where this complication seemed to follow an accident that caused laceration of the right kidney.

In acute cases the temperature may reach as high a level as 103° or 105° F., the pulse may be above 100, rigors may be present, together with very severe pain in the region of the bladder with great frequency of micturition; but cystitis due to colon bacilli may also be chronic, and this is a very serious affection, which may last for a very prolonged period. Lockwood is of opinion that it is better not to wash out the bladder during the acute stage, but that it is a very useful form of treatment in the chronic stage; and that the most efficient treatment is by the use of antiseptic drugs, such as urotropin and helmitol, which should be prescribed in doses of from 10 to 15 gr., and their administration kept up for a long time. He has never seen any harm result from the prolonged use of these urinary antiseptics. If the bladder has to be washed out, nitrate of silver, beginning with a dose of $\frac{1}{10}$ gr. to the ounce, is probably the most

efficient remedy. Up to the present time the results of treating colon bacillus cystitis with colon bacillus vaccine are uncertain; and it would seem that better results have been obtained with other forms of infection, especially staphylococcal infection, by this form of treatment.

Bacillary infections of the urinary tract are by no means confined to adults, and a considerable number of cases occur in *children*, which, according to Box,¹ can be classified in three groups: descending infections, ascending infections, and infections by contiguity.

Descending infections may occur as the result of a considerable number of diseases, and give rise either simply to undue irritability of the bladder or to pyelitis or cystitis of varying degrees of severity. As instances of this descending infection, Box quotes the bacilluria of typhoid fever and the occurrence of slight pyelitis or of transitory incontinence of urine in such diseases as measles, scarlet fever, and diphtheria, and he draws attention to the rather remarkable fact that in the bacilluria associated with typhoid fever, scarlet fever, measles, and diphtheria the organism present in the urine has on many occasions been found to be the bacillus coli. It is probable that so long as the kidney remains perfectly normal the number of organisms present in the urine as the result of a blood infection is small. When organisms appear in the urine in large numbers, even if blood, albumin, or pus be absent, yet it is probable that the efficiency of the renal filter has in some way been damaged, although it is quite exceptional in these cases of bacilluria associated with the acute infective fevers to find gross evidence of renal damage such as is afforded by the presence of casts or blood. According to Box, the fact that the bacilluria of typhoid fever and diphtheria, scarlet fever, and measles is so often due to the colon bacillus is perhaps an argument in favor of the infection really being an ascending one, although it at first sight seems to be descending.

In ascending infections it is probable that the ureter is the channel of infection, although some writers have been inclined to think that the lymphatics or even the vascular system may be the channel. Still, the subject is by no means as simple as at first it seems, because there is experimental evidence that the kidney may be infected as the result of an artificially produced cystitis when the ureter has been ligatured, and it would certainly seem in such an instance that the infection must really be a descending one and dependent on the organism reaching the kidney through the blood.

Some years ago I carried out some experiments on the artificial production of *hydronephrosis* by ligature and division of the ureter in dogs with full antiseptic precautions. Although the ureter was ligatured at a considerable distance from the kidney, and although the antiseptic precautions in no case failed, yet in a considerable number of instances

¹ Lancet, January 11, 1908.

a pyonephrosis developed as the result of ligaturing and dividing the ureter. It is at any rate possible that in these instances the pyonephrosis resulted from the presence of organisms in the blood and their excretion by the kidney, the obstruction of the ureter being sufficient to give the opportunity of the organisms to develop and produce pathological results. At any rate, these experiments were very similar in their results to what is occasionally seen clinically, namely, the production of an acute pyonephrosis as the result of obstruction of the ureter, and yet where there is no preëxistent disease in the lower urinary passages capable of setting up an ascending infection. It must, however, be admitted that the nature of these cases is not fully understood, inasmuch as bacilluria may certainly exist without producing any marked symptoms, and it might be that the obstruction to the excretory channel affords just the opportunity for the development of the pathological effects of an organism that hitherto had existed in the urinary channels, possibly as the result of ascending infection without giving rise to any serious symptoms.

C. J. Bond has shown by a number of observations that particles may be carried by ascending currents into the bladder from the urethra, and that pigment deposited in the bladder may in like manner be conveyed to the pelvis of the kidney. Box is of opinion that Bond's results are not absolutely conclusive, since they were carried out in patients in whom as the result of cystotomy or nephrotomy the normal flow of urine had been to some extent interfered with.

The commonest cause of bacilluria in children is the *colon bacillus*, as is the case in adults, and this affection is much more common in females than in males. Box points out that babies may easily suffer from infection of the urethra with the *bacillus coli*, either from the soiled napkins or from the passage of stools over the vulva. *Colon bacilli* are often found in the urine of children suffering from diarrhœa, and here also the bacilluria is more common in the female than in the male.

Bacilluria as a result of enteritis has usually been looked upon as evidence of descending infection, but the undue incidence, as shown by the fact that two-thirds of the cases occur in females, is rather suggestive of the bacilluria being really due to an ascending infection.

Box draws attention to the considerable frequency with which bacilluria occurs in children suffering from *thread worms*, and he mentions that occasionally the ova of the parasites are found in the urine. He seems to be of opinion that thread worms may in some way be accountable for the urinary infection, either by the irritation and scratching that their presence leads to, or that possibly they may act as carriers of the *bacillus* from the anus to the vulva. Further, he thinks that the beneficial effects of circumcision in some cases of incontinence may be dependent not so much on the removal of a mechanical irritation as the removal of a nidus of bacillary infection. He also draws attention to

the fact that colon bacillus cystitis and pure bacilluria are much more common than causes of pyelitis, and this also suggests that the infection is usually an ascending one. In cases of colon bacilluria, vulvovaginitis is seldom present, and both the cystitis and the pyelitis associated with the bacilluria may be slight in amount.

Infection of the urinary passages in childhood may, according to Box, manifest itself clinically as pyelitis, cystitis, or mere incontinence of urine without any marked phenomena indicative of inflammation. Pyelitis may occur with sudden onset with high fever, and in some instances the temperature chart may closely resemble that of pneumonia; the temperature may rise as high as 105° F. In the early stages the quantity of urine may undergo considerable diminution, but in the later stages polyuria is the rule. Generally the local manifestations of the disease are unilateral, and the right kidney is more often affected than the left.

According to Box, when pain is present it is more generally subcostal than lumbar, and the pain is most severe in those cases where a certain amount of hydronephrosis has been produced. The kidney is tender on palpation and often shows definite signs of enlargement, but this enlargement may rapidly subside. It is possible that the cause of the enlargement is the obstruction produced as a result of the swelling of the mucous membrane of the pelvis. He believes that *pyelitis* occasionally occurs in a much milder form, with no other symptoms than transitory attacks of subcostal pain with slight pyrexia, and he has also noticed that such attacks of pain occur in patients with colon bacilluria who are under treatment merely for incontinence of urine. The possibility of the presence of pyelitis should always be thought of in cases of obscure pyrexia in children, and even for the matter of that, in adults.

Box has drawn attention to the liability of confounding *pyelitis with pneumonia in children*. I have seen more than one instance in adults of attacks of pyelitis running a course very similar to that of pneumonia, in that in both there is a sudden onset with pain and high fever and an equally sudden critical fall. The nature of these cases is extremely liable to be overlooked unless the urine be carefully watched, but where this is done there is really no difficulty in the diagnosis.

Cystitis is also, according to Box, not uncommon in childhood, the onset is apt to be sudden, and very commonly cannot be attributed to any definite cause, and he has met some instances where the attack has apparently followed some apparently trivial injury to the perineum, such as falling astride a chair. Usually micturition is frequent and very painful, but just as there are slight cases of pyelitis, so the cystitis may be slight with no pyrexia and but little pain, increased frequency being the chief feature.

Lastly, *incontinence of urine* may be associated with the bacilluria, which is almost invariably in these cases due to the *Bacillus coli communis*. In some instances incontinence is very slight, but on the other hand some

of the worst cases of nocturnal incontinence may be attributed to this cause. The urine may be turbid from the enormous number of bacilli present, and there may be a notable increase in the quantity of urine excreted. According to Box, in this variety of incontinence associated with bacilluria it is exceptional to obtain a history of either cystitis or pyelitis, but he has noted in some instances definite attacks of slight sub-costal pain which may indicate the presence of slight pyelitis. A history of attacks of diarrhea is not uncommon, and may have an etiological significance.

As regards the prognosis of these various affections in childhood, that of cystitis must be guarded, since although a number of cases clear up with simple treatment, others may persist for months. The prognosis of incontinence of urine due to bacilluria also varies very much.

As regards *treatment*, Box lays the greatest stress on taking all possible measures to prevent urethral contamination from the anus, and any vulvitis present should be treated. Further attention should be directed to the presence of worms, and it is important to order enemata for the destruction of these parasites after the bowels have acted. Box has not been very favorably impressed with the value of urinary antiseptics in cases of colon bacilluria, and he considers that boric acid may produce marked ill effects by causing nausea. The results obtained with anti-bacillus coli serum and also with vaccination have not been encouraging, so that at present the treatment of this condition is unsatisfactory.

Pyelonephritis in Pregnancy and the Puerperium. A number of writers have recently drawn attention to the occurrence of pyelonephritis as a complication of pregnancy and of the puerperium.

Jeannin records 4 instances of pyelonephritis complicating the puerperal state. This author draws attention to the fact that pyelonephritis may appear during pregnancy, but may remain quiescent and only develop after delivery. He thinks the illness may always be divided into two stages, a pre-suppurative one characterized by bacilluria and the latter suppurative. The onset may be extremely violent with severe rigors and a considerable rise of temperature. According to Jeannin the suppurative stage usually lasts for about a week and then subsides as the result of the diminution of the size of the uterus and the removal of compression of the ureters. Five to six weeks may, however, elapse before all the symptoms have disappeared, and although the disease nearly always follows a favorable course, yet he also notes the liability to recurrence in subsequent pregnancies.

French,¹ in the Goulstonian Lectures, 1908, also deals with the subject of pyelonephritis complicating pregnancy. He draws attention to the importance of the dilatation of the ureter that has been noted in these cases and the fact that the dilatation does not generally begin at the bladder but above the bladder at the level of the pelvic brim. Further,

¹ British Medical Journal, May, 1908.

the inflammation is not confined to the pelvis of the kidney, but is a genuine pyelonephritis extending up to and involving the renal cortex, and notwithstanding the fact that even abscesses may be present in the kidney, recovery may take place after nephrotomy.

French seems to be of opinion that the pyelonephritis in all probability results from a blood infection, and that it is not the result of an ascending infection from the lower urinary tract. In support of this view he adduces as arguments that prior to the pregnancy there is no renal trouble, and further, that in a large number of the cases there is no evidence of cystitis. Further, although the ureter is dilated, the dilatation does not involve its whole length and particularly does not involve the terminal portion where it is entering the bladder, and hence it would seem probable that the dilatation of the ureter is dependent on the pressure effects produced at the brim of the pelvis by the enlargement of the uterus. The right kidney is much more liable to be involved than the left kidney, and this he attributes to the fact that the uterus in its enlargement develops much more to the right than to the left; further, it inclines to the right, and it also undergoes a rotation on its vertical axis toward the right. According to French, although pyelonephritis may not appear until quite late in pregnancy, in typical cases it occurs earlier, about the fifth month. He agrees with other writers that the *Bacillus coli* is the most common organism found, and that it is nearly always present in pure culture.

Although the renal infection may theoretically occur either as the result of an ascending infection through the ureter or through the lymphatics or via the blood stream, yet for the reasons given above French is of opinion that the disease is usually the result of a blood infection and that the pathological effects observed are dependent on the slight obstruction of the exit of urine from the right ureter and its consequent stagnation, thus allowing infection of the walls of the urinary channels to take place. It is difficult to account for the entry of the bacilli into the blood from the bowel and especially is it difficult to suppose that these organisms can be present in abundance in the blood without the development of symptoms. The pyelonephritis of pregnancy may readily be overlooked, inasmuch as in the mild cases there may be few symptoms beyond pain in the back which may be regarded as due to lumbago or some other trivial cause. In the more severe cases the condition may be confounded, as already mentioned, with pneumonia or pleurisy, and in some of the most severe forms some abdominal complication, especially appendicitis, may be suspected.

A most interesting study on the presence of bacteria and pus in the urine of pregnant women has been made by Albeck.¹ A review of his work is given by Davis in the September, 1908, number of *PROGRESSIVE MEDICINE*, page 152.

¹ *Zeitschrift f. Geburtshülfe und Gynäkologie*, 1907, vol. ix, No. 3.

SURGERY OF THE EXTREMITIES, TUMORS, SURGERY OF JOINTS, SHOCK, ANESTHESIA, AND INFECTIONS.

By JOSEPH C. BLOODGOOD, M.D.

SHOCK.

THE most important contribution on the treatment of shock and hemorrhage was discussed in *PROGRESSIVE MEDICINE* last year (December, 1907, p. 135); that is, the direct transfusion of blood by an arterio-venous anastomosis between a normal individual and the patient. The only danger is that the donor's blood may not be isotonic with that of the receiver. From the practical experience of Crile and others this danger is slight. For this reason, in cases of sudden hemorrhage, threatening death, I believe it is justifiable to perform the direct transfusion after Crile's method without a previous blood test. If there is time the blood test should be made.

Simon, of Baltimore, recommends the following test: Collect from the *normal* individual—the donor—blood in a vial containing a 1 per cent. solution of sodium citrate in normal salt solution; this is to prevent coagulation. Shake down and wash the corpuscles three or four times, then make a 5 per cent. emulsion of these corpuscles in normal saline solution. The blood is best collected in a small test tube in which you have placed about 4 c.c. of the sodium citrate solution; after the ear is pricked deeply the lobe is milked until from 0.5 to 1 c.c. of blood is collected. To shake this solution of blood and sodium citrate a centrifuge is necessary; the washing should be done three or four times, pouring off the excess each time and adding new salt solution. Now a 5 per cent. emulsion of the corpuscles is made with normal salt solution.

To get the *patient's* serum collect the blood from the ear in a very small glass tube closed at one end, and dilute this 1 to 5 in normal salt solution; to get the serum from the blood drawn, allow the blood to coagulate in the tube, separate the clot with a platinum needle, shake down in a centrifuge, and pour off the serum. Now take one part of the corpuscles of the donor, one part of the serum of the patient, and one part of normal salt solution; incubate this for one hour, then shake down again in the centrifuge. If the solution is tinged red, hemolysis has

taken place between the donor's corpuscles and the patient's serum. According to Crile, in his address on the cancer problem before the last meeting of the American Medical Association,¹ hemolysis between the donor's corpuscles and the patient's serum will do little harm, but reversed hemolysis, that is, between the donor's serum and the patient's corpuscles, strictly contra-indicates transfusion. Therefore, two tests should be made, and the most important one is just the reverse of the one quoted from Simon; that is, get the serum of the donor and the corpuscles of the patient. As a matter of experience, however, up to the present time reversed hemolysis is rarely observed, and, according to Crile, only in inoperable tumors.

I would suggest that surgeons and their hospital assistants immediately familiarize themselves with the technique of these blood tests, and the technique of arteriovenous anastomosis between the radial artery of the donor and the basilic vein of the patient. The technique is given by Crile.² A set of instruments necessary for transfusion has been placed on the market.

The subject of surgical shock has been discussed in the December numbers of *PROGRESSIVE MEDICINE* since 1899, with reference to the best literature. It is one of the most interesting problems in surgical physiology. To prevent and treat shock, one must have a conception of its physiological phenomena. It would be but repetition of what has already been said in these pages to go over this question again, but from a recent and somewhat extended personal contact with many physicians and surgeons throughout the country, I am forced to the opinion that the majority need post-graduate study on this subject. If the contributions to shock already made are carefully read, and the principles there clearly expressed are borne in mind in the daily clinical observation of shock, I am confident that its prevention will be more frequent, and, when it does occur, its simpler treatment more efficacious.

The treatment of shock, therefore, depends upon a true conception of its physiology, on the mastery of the technique of arteriovenous anastomosis, and the blood test. All of these are simple.

The Nature of Shock. The contribution by the physiologist, S. J. Meltzer,³ of New York, which has just appeared, is a very welcome one. I am sorry I cannot present the views of W. T. Porter, Professor of Physiology of Harvard University, which he gave in a short summary before the Clinical Society of Surgery, but Meltzer gives references to Porter's publication as well as to the more recent literature.

In the beginning, Meltzer distinguishes between physiological shock, which is practically not progressive, and clinical or surgical shock, which is progressive but not always fatal. In previous numbers of *PROGRES-*

¹ Journal of the American Medical Association, June 6, 1908, 1, 1887.

² Annals of Surgery, September, 1907, xlv, 329.

³ The Archives of Internal Medicine, July 15, 1908, i, 571.

SIVE MEDICINE I have described physiological shock, which consists of the temporary suppression of the spinal reflexes after direct injury to the spinal cord. Meltzer gives some of the earlier clinical pictures of shock recorded by H. Fisher, Sir Astley Cooper, and John Hunter. These, like all the clinical contributions from the leaders in the older times of medicine, remain good today. Meltzer considers the essential symptoms of traumatic shock as one of profound general apathy, reduced sensibility, extreme motor weakness, great pallor, a very rapid, small pulse, thready and soft arteries, irregular, gasping respiration, and subnormal temperature. This traumatic shock is characterized by its sudden onset, the rapid development of the symptoms immediately after the injury, and, according to Meltzer, should be distinguished from surgical shock, which develops in the course of some surgical operations, most frequently upon the abdomen and the brain.

He then discusses the various theories of shock: Fisher's, founded upon the classical experiment of Goltz, in which the abdomen of a frog was struck repeatedly. Fisher looked upon shock as a vasomotor paralysis, and vasomotor disturbances with a primary cause. All other symptoms were secondary phenomena, due to the consequent anemia brought about by the accumulation of blood in the large veins of the abdomen. Gröningen was of the opinion that all the nerve centres were equally affected, not by paralysis, but by exhaustion due to traumatic overstimulation, while Mansell Moullin favored the view that the centres were inhibited and not exhausted. Crile distinguishes between shock and collapse, and looks upon shock in the same way as Gröningen; that is, as an exhaustion due to overstimulation; but Crile is of the opinion that the vasomotor centre is chiefly affected, while Gröningen assumed that all nerve centres were involved. Meltzer sees in Crile's description between shock and collapse the following distinction: "The onset is gradual in shock, sudden in collapse; collapse may have its origin in cardiac, respiratory, or vasomotor insufficiency; shock is a vasomotor origin only; collapse is amenable to stimulants and stimulation; shock is not; in shock the vasomotor centre is exhausted; in collapse, if this centre is affected, it is only functionally depressed."

This is also my understanding of Crile's distinction.

Meltzer is not willing to discuss whether a distinction between shock and collapse can be made at the bedside, although, as he writes, it might be of practical, vital importance, because in collapse stimulants are indicated, in shock contra-indicated. According to Meltzer the shock described by Crile fits surgical shock only, and differs from traumatic shock, which is sudden in its onset; and Meltzer remarks that he does not think that Crile looks upon the sudden traumatic shock as collapse. Meltzer could not find in Crile's books any discussion in the apparent discrepancy.

I cannot speak from physiological experiments, but from my observa-

tion of traumatic and surgical shock, which have been carefully made, I cannot agree with Meltzer. The description which he has taken from the older writers are of a special group of traumatic shock. Frequently it is not sudden in its onset; for example, a patient may receive a crushing injury to the limb and at first not be shocked, but the continuous afferent impulse of pain from the injured tissues, the pain of transportation and the loss of blood bring on gradually a condition of shock. The same is true in surgical shock, although the sudden onset is seldom observed because a surgeon would never willingly, and is rarely compelled to, inflict at once a sufficient trauma to bring on sudden shock. In surgical operations the condition of shock comes on gradually, because of the repeated trauma, increase in the quantity of anesthetic, and the longer exposure of tissues to the air. It is my opinion, therefore, that, at least clinically, the sudden and gradual onset of shock is due to differences in the degree of the cause of shock and not of the pathological physiological process involved.

Boise and Malcolm, although they agree with Crile, interpret somewhat differently. They do not think that surgical shock is due to the paralysis of the bloodvessels and an exhaustion of the vasomotor centres, but that shock is the outcome of a high stimulation of the centre and a strong contraction of the heart and the artery. Meltzer remarks that these theories are not supported by clinical or experimental tests. Howell's views and conclusions, which I have given, tend to explain shock as an inhibition of the centres rather than an exhaustion from overstimulation, and Howell distinguishes vascular and cardiac shock.

Porter and his pupils, from their experimental work, come to conclusions antagonistic to Crile's. They were unable to get a fall of blood pressure on stimulating an afferent nerve, except a depressor nerve. Crushing and electric stimulation of the testicles and all afferent nerves for many hours gave a uniform rise in the pressure, yet in these experiments the animals showed signs of shock. Although Porter offers no theory of his own as to the nature of shock, he is emphatic that the vasomotor centre is neither exhausted (Crile's view) nor inhibited (Howell's view).

I must confess I cannot understand Porter's results. It is quite true, as demonstrated by Crile's and Howell's experiments, and from what I have seen clinically from blood-pressure records, that at first all these afferent stimuli do increase the blood pressure, but later their effect is less, or the centre does not respond at all. It is just these afferent stimuli which at first give a rise in blood pressure that later exhaust the centres and produce shock. But, according to Meltzer, his review of the experimental work shows that the mystery of shock is not yet solved, and the object of his paper is to bring forward some new experimental data which may add some light to this puzzling physiological problem. Meltzer's work should be read in the original. It concerns chiefly the

effect of abdominal incision and the opening of the peritoneal cavity on peristalsis, and the sensibility of the abdominal organs. He does not agree with Lennander in regard to the insensibility of the visceral peritoneum. In short, he found in rabbits, in which one can make out peristalsis through the skin of the abdominal wall, that the moment a skin incision was made or the abdomen opened, peristalsis ceased, to begin again only after the abdomen was closed. He describes various experiments to explain this muscular paralysis or apathy, and also to explain the loss of sensibility of the abdominal viscera which may be brought about by handling and other means. Meltzer concludes that "on the basis of these considerations I venture the assumption, which is not new, that the various injuries which are capable of bringing on shock do so by favoring the development of the inhibitory side of all the functions of the body. This predominance of inhibition makes its appearance at first in those functions which are of less immediate importance to life, and are, therefore, less insured by safeguards protecting their equilibrium. With increased injury the inhibition spreads also to the more vital, and, therefore, better protected function of the nervous system. The early inhibition in the development of shock, of functions of lesser importance, might even be looked on as being, in a degree, conservative measures of protection of the other more important functions of animal life." Meltzer also states that later in shock other influences must become secondarily active. The insufficient activity of one function becomes detrimental to the other, and anemia, asphyxia, or even fatigue or other conditions might become operative during the progress of shock.

This view of Meltzer, it seems to me, agrees with my¹ clinical conclusions. At that time I wrote as follows: "At the present time it is impossible to define shock, chiefly because its exact physiology has not been completely worked out. For this reason we must use the term in a composite sense for a clinical picture which varies in degree and is produced by various factors, some of which we understand and can demonstrate; many of which, apparently, we do not understand. Further experimental physiological work and more exact clinical observations with instruments of precision may simplify the question and allow us to classify shock according to the exact factor or factors which produce it; we may also be able to define and recognize the different clinical pictures in relation to different etiological factors."

HEMORRHAGE AND BLOOD DISEASE.

The direct transfusion of blood by *arteriovenous anastomosis* I mentioned in the treatment of shock, and gave references to some of Crile's publications. Crile has probably had more experience with this than

¹ Surgical Shock, American Practice of Surgery, Bryant and Buck, i, 463.

any other surgeon in this country. He has employed it not only for severe hemorrhages, threatening life, but for chronic recurrent hemorrhages. Ottenberg¹ gives his experience in the German Hospital, New York, with transfusions and arterio-anastomosis, in which he employs a rigid ring, practically along the same principles as Crile's method. The technique is carefully described and illustrated, with references to the more recent literature. One will find in this article a very good description of the different methods, and it brings the subject, historically, up to a later day than Watts' communication.²

Morawitz³ gives his experience with those grave anemias in which apparently the bone marrow and other blood-forming tissues are not diseased, and in which the anemia is secondary to chronic recurrent hemorrhages. He employs defibrinated human blood. From the experience of Crile and others it seems to me that this has no advantage over direct transfusion of blood, and is a much more difficult operation, as I know from my own experience.

Hemophilia. In chronic recurrent hemorrhages, due to the tardy coagulation of the blood, it has been found that the intravenous or subcutaneous injections of fresh human or animal serum will increase the coagulability of the blood and check the hemorrhage. For convenience the antidiphtheritic serum may be employed. Broca,⁴ in discussing hemophilia, gives his experience with this serum treatment. One should use human or horse serum, or the antidiphtheria serum obtained from a horse. For adults the dose subcutaneously is 20 to 40 c.c., and for intravenous injection, 10 to 20 c.c.; children are given one-half this dose. When an operation must be performed on a hemophilic or upon any patient whose coagulation time is increased, an injection should be given twenty-four hours before operation; if the operation must be performed at once, the patient should receive not only an intravenous injection, but during the operation the fresh serum should be dropped into the wound. In the case of hemophilia which I reported last year in *PROGRESSIVE MEDICINE*, we observed no cessation of the hemorrhage when fresh human serum was allowed to flow upon the wound, but we did not use it subcutaneously or intravenously. The facility with which the antidiphtheritic serum may be obtained should make it obligatory to try this method in all cases of bleeding, especially in cases of jaundice, which are not uncommon.

Graves⁵ report on the surgical aspects of hemophilia is of interest chiefly from his two cases, unique in the literature, of ischemic myositis of the forearm resulting in Volkmann's contracture. The muscle in-

¹ *Annals of Surgery*, 1908, xlvii, 486.

² *Johns Hopkins Hospital Bulletin*, May, 1900.

³ *Centralbl. f. Chir.*, 1907, xxxiv, 859.

⁴ *Ibid.*, xxxv, p. 363.

⁵ *British Medical Journal*, March 16, 1907; review *Centralbl. f. Chir.*, 1907, xxxiv, 859.

volved was the pronator teres, and apparently the hemorrhage in and about this muscle was the cause of the interstitial myositis. The deformity differed from that usually in Volkmann's contracture, in that pronation was the chief feature, with little or no involvement of the wrist or fingers.

Purpura. The report of Brandweiner¹ is of interest in surgery of the extremity, because the little spots of purpura annularis teleangiectodes appear chiefly in the skin of the extremity. At first they are ring- or stripe-shaped, do not disappear under pressure, have a pale-brown centre with a ring of bluish or dark red. The spots appear without symptoms and disappear spontaneously after months. Histologically there is ectasia of the capillaries of the skin, and very little hemorrhage; there is also some perivascular round-cell infiltration and some new connective tissue. He looks upon the disease as a trophic disturbance of the vas motor system. It would be interesting to know whether these little purporetic spots have any relation to arteriosclerosis or Raynaud's disease, and whether they could be looked upon as warning signs for preventive treatment. Pasini² describes purporetic spots on the forearm and elbow chiefly in female patients over sixty-five years, which come and go spontaneously. He looks upon them as senile changes in the skin, and they are found only in those patients in which histological examination shows other degenerative atrophic changes in the skin.

I mention these purporetic spots on the extremities chiefly with the hope that it will stimulate further observation of their occurrence, that we may better understand their meaning, and whether they should be looked upon in old people as a sign of arterial disease, which may later lead to gangrene or apoplexy. De Schweinitz, of Philadelphia, has described retinal hemorrhages, which he looks upon, in elderly people, as a warning of future apoplexy.

Salt Solution Infusion. In view of the increasing employment of salt solution per rectum, subcutaneously and intravenously, any warning as to its injurious effects should receive careful attention. Rössle,³ in his autopsy work, was struck by the condition of the heart in patients who had received subcutaneously or intravenously large quantities of salt solution. He speaks of it as the infusion heart. The chief change was a cloudy swelling of the heart muscle; the heart, as a rule, is moist, flabby, and somewhat friable; the blood thin, and the coagula very thin and yellow. No other changes were found in other organs, except there was a good deal of fluid in the lumen of the intestines. He states that in certain lesions of the kidney and the heart in which they have almost reached the limit of their function, salt solution produces an injury of the capillaries and does more harm than good. I am of the opinion that this observation should stimulate a more careful investigation. In a very large experience with the employment of salt solution

¹ *Centralbl. f. Chir.*, 1907, xxxiv, 912.

² *Ibid.*, 913.

³ *Ibid.*, 1908, xxxv, 641.

in various ways I have had no similar examples, but I have always used the method cautiously. Of course, clinical observations may frequently give incorrect conclusions, and to settle this question we need experimental work.

ANESTHESIA.

During the last year, in my experience with anesthesia and thoughts on this subject, I have become more and more convinced of the importance of recognizing and developing the psychical element as well as the details of the mechanical part of the technique of its administration. In the early literature on local anesthesia the term "moral anesthesia" was employed by many with large experience in this method. By this term they meant the psychic influences on the conscious patient. Crile, in a recent paper on the treatment of *exophthalmic goitre*, has brought out, in a very lucid way, what I wish to illustrate. He is of the opinion that some of the deaths in the extreme grades of Graves' disease are the effects of fear, and other mental excitations, on the secretion of the thyroid, which is already overabundant, and, perhaps, pathological. He claims that these fears and excitations can be eliminated, the dangers of anesthesia and operation reduced, and the mortality lessened. His method is somewhat as follows: The patient, on admission to the hospital, is told that she will get well if she will submit to the proper treatment, and that perhaps an operation may not be necessary, but she must give her consent to an operation should it become necessary at any time. The patient is then placed in bed at absolute rest, and the usual method of treatment for *exophthalmic goitre* employed. In addition, the special anesthetist visits the patient daily, places a cone over her face which contains some volatile oil; she is told this is part of the treatment; each day she is told that she is better, and perhaps an operation may not be necessary. On the day decided on for operation the patient is told that she is doing so well with the inhalation treatment that it is proposed to make it a little stronger. Without her knowledge ether is substituted, she is anesthetized, taken to the operating room and lobectomy performed. Crile claims to have reduced the mortality and postoperative thyroid intoxication in this class of cases. Perhaps some readers of this and of Crile's article may be skeptical. It will probably require a larger experience to demonstrate that it actually does reduce the mortality. My experience, however, entirely agrees with that of Crile. It agrees with all the recent literature on the psychic phenomena of both mental diseases and diseases outside the nervous system.

How much the recognition and treatment of the psychic aspects of surgical diseases will influence mortality I am not prepared to say, but there is no question, from my experience, that when the surgeon acquires this art it will reduce tremendously the pre- and postoperative dis-

comforts of his patients and relieve him of an amount of wear and tear which, I am inclined to think, in the future will be shown in the youthfulness of such surgeons when they have reached an age which in the past has been considered the limit of their usefulness.

The development of this thought, of the psychic element in anesthesia, can be carried throughout the entire field of surgery. Apprehension and fear characterize a large number of patients who are told that they have to be operated on. There is no question that the actual mortality and postoperative discomfort at the present time are too small to justify this attitude toward surgery. If patients could be educated to be as pleased when they are told that a surgical operation is necessary, as they are when they are given a tonic, Utopia would be reached.

It is necessary for the general practitioner to coöperate with the surgeon in changing the mental attitude of the public toward surgical intervention.

Speaking specifically again of anesthesia, in the past few years I have attempted to cultivate the art of suggesting to the patient that an operation is necessary, or may be necessary in such an optimistic and happy manner as to relieve him of the mental anxieties as much as possible. I have attempted to create in the hospital an atmosphere and an environment for the patient that will be most favorable to carry on the continuity of this good impression. In the majority of patients I find that it is best to operate upon them as early as possible in the morning, selecting the more nervous patients, if possible, first. In the preparation for operations cathartics are not given on the day preceding the operation, but on the day before this. The day before operation, especially in abdominal cases, nothing is given by mouth except white of egg and water. It is carefully explained to the patient that all these preparations make everything easier and more comfortable for them. The enema is given the night before, instead of the morning of the operation. If possible, the patients are brought directly into the operating room, the field of operation prepared on the operating table, and they are placed in the proper position for the operation before anesthesia is given. It is carefully explained to the patient that this is done to reduce the duration and quantity of the anesthetic; that this reduces even the slight dangers of the operation, and as a rule prevents postoperative discomfort and nausea. Almost every patient comes to operation carefully prepared by his friends with the knowledge that he will be fearfully and wonderfully seasick after ether, and I am convinced that many of the postoperative complications are psychic, suggested by the past experience in surgery when ether was badly given and everything was done to suggest to the patient that he had an ordeal to go through. There is no doubt that the preparation of the patient before the anesthetic is begun reduces the time and the quantity of the anesthetic. Harvey Cushing¹

¹ Surgery, Gynecology, and Obstetrics, March, 1908, vi, 227.

in his recent splendid article on the technique of craniotomy emphasizes this point.

I am convinced that since I have attempted these modifications the patients have had less anxiety before operation, the anesthesia has been more quiet, and postoperative nausea and vomiting greatly decreased. In looking over the literature of anesthesia, and finding such a diversity of views during its development as to the proper anesthetic and apparatus, one cannot but become convinced that the better results in the hands of an enthusiast with his new method may be largely due to psychic influences; the suggestion to any patient that this is a new method, better than any yet employed, is of itself a good influence which bears fruit. Frequently, in my own experience, when patients who had taken ether before, said: "Please don't give me ether; it made me so terribly ill after the last operation;" and when I replied: "Don't bother about that, we give ether by an entirely new method and patients very rarely suffer from postoperative nausea or vomiting," as a rule it has had the desired effect both as to relieving the immediate anxiety and in the postoperative course. "There is, of course, no question that we do give ether better, and less of it, now, and this explains some of the better results, but not all. I am convinced that the psychic element of anesthesia is an important one to consider.

As an illustration, of which there are many others, Williams divides the vomiting of pregnancy into two types: one, psychic, cured by suggestion; the other, toxic, which can only be relieved by emptying the uterus. Surgeons and physicians must not carry the psychic treatment of their patients to an extreme degree; it must not become a fad, because this will certainly lead to a harmful reaction. But this question is one for every thoughtful physician and surgeon to consider, and I am especially anxious to do my part in stimulating the thought of its employment when surgery and anesthesia become necessary.

Scopolamine-morphine Narcosis. The consensus of opinion in recent literature favors the employment of this hypodermic method only as a preliminary to ether or chloroform. Hotz¹ gives his experience with 1500 cases. The evening before operation the patient is given veronal; one hour before operation an injection of scopolamine and morphine, a moderate dose: scopolamine, 0.0006 gm. (gr. $\frac{1}{1000}$) for the male and 0.0004 gm. (gr. $\frac{1}{2500}$) for the female; morphine, 0.01 gm. (gr. $\frac{1}{60}$) for the male and 0.005 gm. (gr. $\frac{1}{200}$) for the female. After this the quantity of ether or chloroform required is very small. Fifteen hundred cases, however, are not enough for definite conclusions as to postoperative complications. He claims they are less. It is a good adjunct, then, apparently for ether or chloroform. It is difficult, however, in an active clinic to know for all cases when the hour before the operation will be, but it seems to

¹ Centralbl. f. Chir., 1908, xxxv, 731.

me that it is justifiable to try it as an adjunct only. It can also be employed before local anesthesia. It is contra-indicated in exophthalmic goitre and in delirium tremens. It should be employed in tetanus. Zeller¹ practically comes to the same conclusions from an experience of 182 cases. Durand² finds it very satisfactory for children. Hirsch³ is of the opinion that in operations upon the mouth and pharynx the long postoperative sleep is a disadvantage.

General Anesthesia per Rectum. I have witnessed this method of narcosis by my colleagues in Boston and New York, at meetings of the Clinical Society of Surgery. There is very little recent literature on this subject. The first foreign reference that I have seen is reviewed in the *Centralblatt f. Chirurgie*, 1907, vol. xxxiv, p. 152. The contribution is by Vidal, a French surgeon. The principles of the method are as follows: The alimentary tract must be cleaned first by a cathartic and then by an enema of 2 liters of fluid containing 2 gm. (gr. 30) of carbonate of soda. The latter is employed to clear the mucous membrane of fat. Half an hour before the anesthesia morphine is given hypodermically, the patient is placed in the middle Trendelenburg position, and a rectal tube introduced. The ether forced by bellows into the tube should pass through an empty flask which rests in a hot-water bath at 39° C., so that the ether vapor is warm. According to Vidal this method is indicated when respiratory complications are threatened. I mention this method because, perhaps, in the development of surgery of the chest it may find larger application, and the mouth can be used entirely for the maintenance of overpressure in the lungs.

That the extreme cyanosis is not necessarily due to any obstruction in the respiratory tract, but to an overdose of the anesthetic, was demonstrated in one of the cases I witnessed. The complication appeared as critical as any I have ever observed in narcosis by ether in the ordinary method. In many operations upon the head and neck it would be very convenient to get rid of the anesthetic paraphernalia in that region, but up to the present time the technique and art of rectal anesthesia have not been sufficiently developed to justify substitution.

Local Anesthesia. There is very little recent literature on this subject, but apparently it still ranks with general narcosis, and is the method always to select if the operation can be properly and painlessly performed. Roith,⁴ in an excellent paper on the indication of the various methods of anesthesia, practically comes to the same conclusions that have been discussed in the previous numbers of *PROGRESSIVE MEDICINE*. He advises novocaine and suprarenal tablets in salt solution. The majority of patients are given previously morphine, or morphine and scopolamine, and very nervous patients veronal some hours before the operation. Unless one can infiltrate beyond inflamed tissue, he should not attempt

¹ *Centralbl. f. Chir.*, 1908, xxxv, 689.

² *Ibid.*, 380.

³ *Ibid.*

⁴ *Beiträge z. klin. Chir.*, 1908. lvii, 246.

operation on inflammatory lesions under local anesthesia. Schleich¹ still recommends cocaine and alypin, the formulæ for which I gave last year.²

Colmers³ gives a new application for local anesthesia to demonstrate in accident cases whether the patient is a malingerer or not. If the local pain complained of in the region of the skin or muscles is relieved by infiltration of cocaine, he looks upon this as evidence that the patient is really suffering. However, he gives no examples of negative observation.

It is to be remembered that in local anesthesia there may be a toxic effect from any of the drugs employed, and in my experience this danger is better avoided by the employment of weak solutions, but I would urgently advise always to be prepared for syncope in local anesthesia, and always operate, if possible, in a reclining position. If not, be prepared to place the patient in this position rapidly. Now and then the syncope may be psychical. In a recent operation on a small dental cyst on the upper jaw of a girl, aged twenty years, I said to her before the operation: "It is very important for you to keep quiet and keep the mouth open until the operation is over; if you do this it will be painless and take but a few minutes." She was apparently courageous, not nervous, and had a good color. The operation took about ten minutes; it was apparently painless. At its completion I said: "Now, it is all over." The patient immediately relaxed and fainted. She told me afterward that when I said that to her she ceased her mental effort and immediately lost consciousness. This syncope, however, is not always psychic; and in old, feeble patients, and individuals with weak hearts it must be constantly borne in mind. I have previously reported in *PROGRESSIVE MEDICINE* a sudden death, on the table, of a patient with a very weak heart during an operation for hernia under local anesthesia. In a recent experience with an old male, aged seventy-five years, suffering with a chronic fistula in ano and hemorrhoids with prolapse, I excised the fistula under cocaine infiltration, a very weak solution; it was not a painless operation; on reaching the bed in his room he had a very serious syncope; fortunately I had anticipated it and had sent the anesthetist with him. Later, I excised the lower end of the rectum under ether narcosis; the patient was very much less upset, and there was no syncope after this general anesthesia. This experience will be found recorded in the literature, and one must remember that in local anesthesia the depressants to be considered are psychic, physical pain, and the toxic effects of the local anesthetic used. In strong individuals these are insignificant, but in weak and nervous patients they must be considered; and if the operation is of such a nature that it would be

¹ *Centralbl. f. Chir.*, 1908, xxxv, 365.

² *PROGRESSIVE MEDICINE*, December, 1907, 146.

³ *Centralbl. f. Chir.*, 1908, xxxv, 25.

difficult to perform it without these factors being present to a considerable degree, general anesthesia is not only safer, but more humane.

As I have stated under General Anesthesia, as our experience increases in the ether-drop method, accompanied by the adjuncts of morphine and atropine, psychic or mental suggestive influences, and in some cases a hypnotic, like veronal, the night before the operation, we find that the dangers of general anesthesia are at least no greater, and in some instances perhaps less, than local anesthesia. Due to these facts, and although surgeons are more familiar with local anesthesia, I believe its field of employment is getting rather narrower than wider, but it retains its distinct place.

Experience is also demonstrating that postoperative pneumonia is more frequently prevented by looser abdominal dressings, sitting the patients up immediately after operation and getting them out of bed quicker than by the substitution of local for general anesthesia. Even when local anesthesia is employed in laparotomy in debilitated patients, the same precautions should be taken as after general anesthesia. In a very recent observation at an exploratory laparotomy in a debilitated and anemic patient with symptoms of obstruction at the cardiac orifice of the stomach I made three abdominal incisions under cocaine, let out the fluid, found a diffuse carcinoma of the stomach, closed the wound with layers of catgut, sat the patient up immediately in bed, and allowed him to get up and walk after forty-eight hours. This is by no means very new, but a sufficient number of my colleagues have demonstrated the importance of such a procedure to prevent lung complications. It is another evidence that the older after-treatment, with absolute rest in bed, flat on the back, for the healing of a laparotomy wound, is incorrect. I mention this here to demonstrate that the enthusiastic reception and ready adoption of local anesthesia was due to the fault in the art and technique of general anesthesia and postoperative treatment.

Spinal Anesthesia. Lindenstein¹ reports on 500 cases from Göschel's Clinic in Nürnberg. On the whole they are satisfied, but they will not increase the indications in males, and shall in the future decrease them in the female. In spite of their own conclusions, a comparison of their table with 500 ether-drop narcoses or local anesthetics for the operative interventions, in which they employed lumbar anesthesia, would be very unfavorable to the latter. Cocaine was never employed. Stovaine, after the first 50 cases, was replaced by novocaine, with a few cases of tropacocaine. In their last 100 cases there were 4 failures, 2 collapses, 6 vomitings during anesthesia, and, after operation, 23 suffered from headache and 10 from vomiting. I do not think an American surgeon would be satisfied with such a record, unless general anesthesia was distinctly contra-indicated.

The experimental work of Krönig and Gauss² confirms a similar

¹ Beiträge z. klin. Chir., 1908, lvi, 601.

² Centralbl. f. Chir., 1908, xxxv, 7.

work by Barker,¹ to which they give no reference. They conclude that stovaine is the better drug because its solutions are more nearly equivalent to the specific gravity of the spinal fluid. This is entirely opposite to the clinical experience of Lindenstein.²

Chaput,³ in a very limited experience, has employed it for operations upon the chest, breasts, and head, with, according to his view, very satisfactory results. He gives one hour before operation an injection of scopolamine. He employs a solution of stovaine and cocaine, 3 to 1. Ten to 15 c.c. of the spinal fluid are withdrawn, and 8 c.c. of the anesthetic introduced 4 c.c. at a time. Suggestion is employed. He claims that the anesthesia reaches the face in fifteen minutes and remains good for one-half hour. If there is syncope he places the patient in the Trendelenburg position. Most authorities look upon this as dangerous. Of course there must be pioneers in every field, but it seems to me that if this is considered better than general anesthesia, the method employed in this clinic needs improvement.

Careful observations of the *urine after lumbar anesthesia* have been made. Czermak⁴ found in a series of 60 cases in which the urine was normal before operation 35 per cent. of abnormal urine, chiefly albumin, and a few cases of casts and blood cells, but not a single instance that could be looked upon as nephritis of a graver form. If the urine be carefully examined after any form of anesthesia, I am inclined to think from my own experience that this temporary albuminuria, with or without cells and casts, is present in a number of cases, and I do not look upon this as any contra-indication of the method. It is important, however, to remember that it does occur.

I shall not discuss the other literature of the year on this subject. The reading of the experience of eight or ten surgeons, with from 100 to 400 cases each, impresses me that if they were familiar with the results of good ether anesthesia by the drop method, or local anesthesia in suitable cases, they would restrict the use of lumbar anesthesia. In fact I would strongly advise against its employment in this country.

Complications during Anesthesia. This subject has been considered from time to time in PROGRESSIVE MEDICINE, and experience has demonstrated that these complications are best avoided by preventive treatment; but now and then, in spite of every precaution, a complication does arise which is usually fatal unless we have means at hand for immediate action. The most serious complication is heart-collapse, which is observed usually in chloroform narcosis, but is not impossible when cocaine is employed either subcutaneously or in lumbar puncture. This collapse, as a rule, takes place in patients debilitated by disease,

¹ British Medical Journal, March 20, 1907.

² Loc. cit.

³ Ibid., p. 8.

⁴ Centralbl. f. Chir., 1908, xxxv, 191

or who are suffering from some chronic heart lesion, especially myocarditis.

Careful examination of patients before operation generally prepares the surgeon, and this heart collapse may be prevented by the use of ether. Nevertheless, any contribution as to the best method of treatment is welcome. Kothe¹ reports his experience with two critical examples of collapse of the heart after lumbar puncture with cocaine for anesthetic purposes. Every ordinary means failed until adrenalin was injected intravenously. He gives Heinz² credit for demonstrating the analeptic action of adrenal extracts. I have discussed this method previously in *PROGRESSIVE MEDICINE*, and I agree with Kothe that up to the present time it is our best available means of resuscitation. I prefer, however, to employ Crile's method in which 10 to 15 drops of the adrenalin solution are injected with the hypodermic syringe directly into the rubber tube which is carrying the salt solution for intravenous infusion already started. Kothe remarks that at the recent meeting of the German Surgical Congress it was concluded that massage of the collapsed heart through direct operative exposure has not proved sufficiently efficacious to justify this severe measure. At the present time I should advise the employment of adrenalin in salt solution intravenously. One should be cautious in its employment and remember that its effect is only temporary; it should not be repeated.

That *massage of the heart* should be attempted, especially when the collapse takes place during a laparotomy, is demonstrated in the case reported by Depage.³ Here during a laparotomy for gallstones, under chloroform, heart collapse took place; all ordinary means failed. It is not stated whether adrenalin was employed. The surgeon then grasped the heart through the diaphragm, using the abdominal wound for his portal of access. There was immediate response, and the operation could be completed; the patient recovered.

The experimental work on animals, which has demonstrated the toxic effect of repeated doses of adrenalin, especially marked arteriosclerosis, cannot be used as an argument against the employment of a few drops of this drug for the purpose of resuscitation from heart collapse, and I find nothing in the two most recent communications by Watermann⁴ and Shirokogoroff⁵ to contradict this statement. Repeated intravenous injections of adrenalin are apparently distinctly contra-indicated. It is of practical interest to note that these animal experiments demonstrate that the dangers are absent if adrenalin is employed subcutaneously or in the peritoneal cavity. We have, therefore, no evidence against its use in local anesthesia. I find no experimental investigation

¹ Centralbl. f. Chir., 1907, xxxiv, 970.

² Experimental Pathology and Pharmacology, 1908.

³ Centralbl. f. Chir., 1908, xxxv, 390.

⁵ Ibid., p. 482.

⁴ Ibid., p. 640.

as to the general effect of adrenalin when injected into the lumbar sac. At the present time it is employed in conjunction with the anesthetic in lumbar anesthesia. We must remember, however, that adrenalin is a drug to employ with great caution.

WOUNDS AND WOUND TREATMENT.

It is important, in the treatment of wounds and their complications, to have a correct conception of the inflammatory process. I have found for my own benefit that Adami's little book is one of the most satisfactory among recent publications.¹ Adami calls it an introduction to the study of pathology. It is a small volume of about 230 pages, carefully indexed, and with references to the most important literature. I would recommend this book to every practitioner, because I am sure that in its careful perusal one will glean many ideas of practical importance.

It has required years to impress the profession that in order to treat disease with the best results one must have a clear mental picture of its pathology and an experience of what Nature can and does accomplish unaided. The better a physician is equipped with this knowledge the more will he assume the attitude of observation and non-interference, and the better will he be able to interfere successfully when action is indicated.

In the history of military surgery, in the so-called first aid to the injured, the principle of observation and non-interference has been firmly established after a long and bitter experience. Ambrose Paré was one of the first to formulate the principle of, and advocate, non-interference. Paré after a great battle, in which the number of wounded was too great to be looked after by the surgeons, found to his surprise that those who had received no treatment were more comfortable; their wounds healed quicker and better, and there was less mortality.

Lister, in the early days of his antiseptic treatment of compound fractures, from which he formulated the principles of his treatment of wounds, interfered very little. Nothing was done to the wound communicating with the fractured bone, except swabbing with pure carbolic acid and allowing the wound to become plugged with a clot of the changed acid and blood. Lister was the first to observe healing under blood clot, and this was due to his attitude of observation and non-interference.

From Lister's startling results surgeons, in their confidence in antiseptics, interfered more and more in compound fractures, and their results, due chiefly, of course, to faulty technique, were not as good as

¹ Inflammation, Macmillan & Co., New York, 1907.

those of the father of modern surgery. In spite of the fact that with the present-day technique one can interfere, if necessary, in a compound fracture, experience has demonstrated that in the majority of cases the wound-healing is just as satisfactory if practically nothing is done, except external disinfection.

Adami's entire description of the inflammatory process is an argument based upon his own experience and that of others, experimental and clinical. This argument favors the conclusion that all the evidence points to the fact that inflammation is in itself a curative process, and that if its activities are confined within certain limits it is best to leave it to itself.

These activities may be faulty in two directions. They may be insufficient or excessive. The art, therefore, in the treatment of inflammatory processes, consists in the recognition of the extent of these active processes. If they are insufficient, means should be employed to increase them; this is the principle of Bier's hyperemia. If they are excessive, means should be employed to control them. In this latter instance, operative interference may be indicated.

Applied to practice, the results of the experimental investigations on the inflammatory process can be of the utmost value. Here we have a concrete demonstration of the practical importance of experimental investigation for surgery.

The surgeon, therefore, to keep himself abreast of the times, must not be content with his clinical work only, but must read and study the results of experimental investigations which are of practical value in his daily work.

In the literature on the treatment of wounds, accidental and operative, we can observe the influence of this experimental investigation on the nature of the inflammatory process. Methods have become simpler, tissues are handled with greater care, are not ligated *en masse*, nor insulted with gauze tamponing unless distinctly indicated; irritating antiseptic solutions are not employed, except when absolutely necessary; drainage is resorted to less frequently and when indicated is arranged for on more scientific principles; the rule of absolute rest has been found unnecessary, except when specially indicated.

Increased circulation is one of the most important factors in the inflammatory process. Rest, on the whole, decreases the circulation; activity increases it. For this reason, if the inflammatory process is excessive, rest is indicated; otherwise, not. If the activity of inflammation is insufficient, means must be employed to increase it. Use of the injured part is one of the simplest means at hand. With this correct conception and with the power to recognize the condition of the inflammatory process, one is equipped for the best treatment.

The treatment of wounds is based, first, upon our knowledge of bacteriology, and, second, upon our conception of the inflammatory

process. In the wounds which a surgeon makes, the endeavor is to prevent the entrance of bacteria and to so handle the divided tissues that the inflammatory process will be sufficient for proper healing. In accidental wounds we have to bear in mind the possibility of their infection, which is a very variable matter, both in the number and the virulence of the organisms. In closed wounds which have healed *per primam* there is very little further treatment. The surgeon, however, must know when such wounds have healed sufficiently solid to allow the divided tissue to return to its former function. I will return to this point. In open wounds there is, first, the problem of drainage, and, second, the treatment of the granulation tissue which rapidly forms.

The next problem is the treatment of old wounds. Here we have sinuses, fistulæ, or ulcers, but, as a matter of fact, it is always granulation tissue.

Operative Technique. This technique is pretty well established. At the present time the majority of surgeons properly trained do not fear that their closed wounds will not heal *per primam*. To accomplish such results there must be eternal vigilance in every detail. Webster,¹ in an editorial, emphasizes the importance of the absolute supervision of every detail. He states what is quite true, that although technique is simple in theory it is elaborate in its practical detail.

Recent literature concerns itself chiefly with the sterilization of the hands, which will be so thorough that gloves will become superfluous, with the substitution of gloves by some protective substance with which the hands are covered. The only objection to gloves is their expense. It is my opinion that there is no simpler or better method than gloves, and I doubt if, on the whole, there is any difference in the cost. Nevertheless these investigations have their value because they may be applied to the cleansing and disinfection of the skin in the field of operation, for which, up to the present time, a protection like that of the rubber glove to the hand has not been satisfactorily provided. Meissner² has made extensive studies with alcohol alone, with the conclusion that for practical purposes it is good enough, and that the cheaper wood alcohol (methylated spirits) is just as efficacious. The disinfection of the hands and the skin with alcohol is a very simple way, and can be easily combined with scrubbing with hot water and soap and bichloride. The majority of surgeons depend upon this alone and get good results. I would advise no one to depend upon alcohol only, but it should always be part of the technique of skin cleansing.

Lenzmann³ objects to gloves on account of their expense and clumsiness. If the method recommended by him gives the results he claims, I should look upon it as a distinct advance for cleansing of the hands and

¹ Surgery, Gynecology, and Obstetrics, 1908, vi, 200.

² Beiträge z. klin. Chir., 1908, li, 191.

³ Centralbl. f. Chir., 1908, xxxv, 89.

the skin in the field of operation. I shall give it a trial, but not as a substitute for gloves.

The greatest difficulty in disinfecting the hands is the presence of bacteria in the hair follicles and glands of the skin. Lenzmann has claimed that his specially prepared soap reaches and fills these skin follicles. He has demonstrated this by mixing fuchsin with the soap and making sections of the skin. The method is as follows: The skin is shaved and washed with ordinary hot water and dried with sterile gauze; then the field of operation is covered with this special soap and left on for two hours or more, when it is washed off and the skin covered with a moist bichloride dressing. Before operation the skin is again cleaned by the same method that he employs for the hands.

The hands are washed in a soda mixture and then cleansed with the special soap, which consists of 5 parts of formalin, 15 parts of benzine, and 80 parts of the soap called dermosapol. This soap contains a mixture of cod-liver oil (50 per cent.), fat, lanolin, glycerin, balsam of Peru, and ethereal oils. He claims that there is no irritation to the hands or the skin.

The soap poultice is nothing new; it has been used years ago; it was part of the technique in the early days of Dr. Halsted's clinic; it has been found unnecessary, except in special cases.

This cleansing of the skin the night before and the poultice during the night, and a second cleansing on the table should only be done if necessary. There is no question that it is uncomfortable and adds to the ordeal before the operation. The consensus of opinion of all surgeons agrees on cleansing the field of operation just before the operation.

Grasman,¹ from his experiments, recommends the iodine-benzine method of Heusner. Von Brunn² concludes that there is no method which will completely sterilize the skin of the hand or of the field of operation. He is of the opinion that benzine in the iodine-benzine method of Heusner may irritate the skin. Meissner³ gives his opinion in regard to chirosoter as a substitute for rubber gloves. It does not appear to me that it has any advantage.

The review of this recent literature, combined with my own experience, forces me to repeat the statement frequently made before in these pages, that our present methods of technique in surgery are sufficiently good, but success depends on careful attention to every detail. Surgeons in the first place must keep their hands in good condition, avoiding all abrasions. The slightest cut should be immediately protected until healed; pimples on the forearms should be disinfected with carbolic and protected with collodion; unless absolutely essential for the good of the patient, surgeons should never handle infected tissues except with gloves; they should learn to make dressings with instruments, so that

¹ Centralbl. f. Chir., 1908, xxxv, 99.

² Beiträge z. klin. Chir., 1907, liv, 630.

³ Ibid., 699.

their hands do not come in contact with wounds; in operations, after the hands are cleansed, they should be protected with gloves; the sterile gown should have long sleeves; the mouth should be protected with gauze; a cap covering the hair should be worn. It is the consensus of opinion that a surgeon should be clean shaven; if he prefer to wear a beard he should protect it with gauze during the operation. In cleansing the skin, scrubbing with soap and water for at least five minutes is the most important point in technique. This should be followed at least by ether, alcohol, and bichloride. In my own experience, and from what I have observed in the majority of clinics in this country, closed clean wounds heal without suppuration. The test of the technique is the fearless use of silk as a suture or ligature.

The Treatment of Closed Wounds. Here, again, a conception of the inflammatory process and the natural healing of different tissues is a great aid to the surgeon. The irritation in a closed clean wound must be looked upon as minimal. Therefore, the inflammatory reaction may be insufficient; absolute rest will not increase it. Therefore, surgeons may err on the side of keeping their closed wounds at rest too long. Slight motion will increase the inflammatory reaction and theoretically healing. Absolute rest, as a general rule, is not good for the patient. If a healthy man or woman is put to bed at absolute rest for a number of days the circulation will not be as good and all the functions of the body will be somewhat deleteriously affected. We have learned from practical experience that it is unnecessary to keep patients with laparotomy wounds in bed three weeks; five to seven days is sufficient; we find the wound just as strong, and the patients are in very much better general condition. This is also true in fractures; if the fragments can be kept in position with the patient up and about, this is best for healing the wound. Years ago Billroth called attention to the fact that in fractures of the clavicle, where it is impossible to get absolute rest and no motion, bony union was most quickly accomplished.

This year I shall not go into detail in regard to all the evidence in favor of allowing patients to move about in bed, to sit up, and to get up earlier than heretofore; but I wish to call attention to the fact that this slight motion is theoretically good for the healing process, and, from practical clinical observation, wounds heal just as well and the patient's condition is greatly benefited. Postoperative pneumonia and phlebitis are less frequent, as based upon accurate statistical studies; abdominal distention and constipation are also less frequent.

This treatment must be modified in drained wounds. Drainage itself is an irritant and sufficient for the healing process. In suppurated and infected wounds the inflammatory reaction is excessive, and as a rule they do better under rest.

Accidental Wounds. There is nothing new in the treatment of these wounds. All of them must be looked upon as infected. In every acci-

dental wound the first thought should be, Is there any possibility of *tetanus*? In this event the antitoxin should be given at once. This statement has been given widespread publicity in the medical and lay press, but apparently not sufficiently so. In the last week I have seen a case of tetanus following a punctured wound of the foot from a rusty nail in a cow stable. In every case of this kind the patient should at once receive the antitoxin. From experience we know that the majority of clean-cut accidental wounds will heal if cleansed and closed. Experience only teaches the surgeon when such wounds should be left open. Decision in regard to this is based upon the instrument that produced the wound, the possibility of soiling after the wound was made, the period of time from the infliction of the wound to the first dressing, and the extent of contusion and laceration. The recognition of these elements and the decision as to how to act is the art of surgery. Science teaches us that the tissues will take care of the bacteria in the majority of accidental wounds. Any disinfection after an accidental wound will not prevent blood infection, but in the majority of cases this is insignificant. If a surgeon injures his hands with a knife, needle, or any instrument while operating upon an infected case, he should immediately place an Esmarch around the arm and then lower down above the wound, open the wound, allow it to bleed, disinfect it with pure carbolic, and leave it open. From experimental investigation on animals this should protect the surgeon in the majority of cases. It is all that can be done until we get a polyvalent antitoxin.

Recently a colleague of mine pricked his finger during an operation on a streptococcus case; he did nothing for his wound; there were practically no local symptoms, but in forty-eight hours signs of phlebitis of the arm and involvement of the axillary glands, and general infection developed, from which he did not recover.

The Treatment of Infected Wounds. There are all grades of infection. In the majority of cases surgeons can control and overcome the local infection by various operative and non-operative measures. Seen early, before general infection has taken place, surgeons can, in the majority of cases, accomplish a cure by the proper treatment of the local infection. In early cases Bier's hyperemia and rest may be sufficient; with this, in some cases, small incisions may be enough, but in severe cases the essence of treatment is wide incision, and, if possible, excision of the infected tissue. If in doubt, err on the radical side. When it is necessary to remove infected glands in the axilla, neck, or groin, *do not close the wound*. Burkhardt¹ gives a very interesting article on the action of pure oxygen on wounds and infections, but it does not impress me as having any advantage over simpler and more accessible means. Asbeck² recommends dressings dried by heat. I can find nothing to commend

¹ Deut. Zeitschr. f. Chir., 1908, xciii, 181.

² Centralbl. f. Chir., 1907, xxxiv, 155.

this treatment. Lennander reviews the employment of pure carbolic acid—a treatment previously discussed in these pages. I look upon this drug as our most important agent for disinfection, and it should always be used in a concentrated form, followed by alcohol, and credit should be given to Lister, and not to more recent authorities who recently reintroduced his methods.

In the treatment of an infected wound we must bear in mind that, first, the patient must be saved from general infection, and, second, we must attempt to prevent as far as possible destruction of tissue in the locality of the infection. To save the patient from general infection it may be necessary in some instances to sacrifice the local part, for example, by amputation. Nevertheless, experience has demonstrated that if infections are seen early a cure can be accomplished without loss of limb and with preservation of function of the part infected. Heile¹ gives a very interesting and scientific contribution on new ways to increase and accelerate the natural healing processes of the body in morbid conditions. For the local inflammatory process he recommends Bier's hyperemia; the x-rays for increasing the general resistance; tuberculin in tuberculous patients, and nucleic acid in pyogenic infection. Mikulicz had previously demonstrated that the resistance of the peritoneal cavity to infection can be increased by the injection of some nuclein twenty-four to forty-eight hours before operation. Apparently there is no doubt as to the value of tuberculin in all cases of tuberculosis, but in other infections methods to increase general resistance are not yet firmly established, notwithstanding extensive research work in this direction. As I stated before, we know that in chronic alcoholism resistance to infection is lowered, owing to the absence of the complement in the blood, but up to the present time we have no positive method of overcoming this blood defect.

There is room for a monograph on the treatment of local infection, and from my own experience, what we need now, is not so much new methods or new drugs, but a diffusion of the knowledge of the means and methods which can accomplish and have accomplished good results if properly employed.

The Treatment of Ulcers, Sinuses, and Fistulæ. In these conditions the patient has usually passed the danger of general infection, and we are dealing with a chronic local condition in which, for some reason, the wound does not heal. The entire problem is, first, to find out why the wound does not heal, and, second, the proper treatment of granulation tissue. *One must remember that the tendency of every wound is to heal, and when this does not take place there is a definite cause.* This may be a foreign body, or dead tissue, bone, tendon acting as a foreign body; a communication of the wound with a cavity lined by mucous mem-

¹ Centralbl. f. Chir., 1907, xxxiv, 978.

brane of any of the hollow viscera; a specific infection, like tuberculosis, syphilis, actinomycosis, etc., or a newgrowth. In some cases, when all of these factors are absent, wounds do not heal because the granulation tissue, on account of its fibrous base, does not receive proper circulation, and for this reason the granulation tissue cannot destroy the pyogenic bacteria and fill up the cavity; or, if it be an ulcer, epidermization is impossible over the edematous suppurating surface of the granulation tissue. Before the healing of such a wound is attempted, all removable causes must be investigated. When this has been accomplished, conservative measures should be tried. The ideal treatment, of course, for every ulcer, sinus, or fistula is complete excision. But this is contra-indicated in many cases on account of the extent of the disease or the incidental mutilation. Healing can be accomplished in the simpler group by careful cleansing and the use of carbolic acid, balsam of Peru, or injections of bismuth. On the whole, injections of bismuth is the simplest method. Hoffmann¹ claims that there is some danger of nephritis if balsam of Peru is extensively employed. I have never observed it in a long experience. Suter² is one of the most enthusiastic advocates of balsam of Peru. I have had unusually good results with it. Emil G. Beck,³ of Chicago, contributes an excellent article on the employment of *bismuth paste* for the diagnosis and treatment of fistulous tracts, tuberculous sinuses, and abscess cavities. As he is especially interested in getting reports on this method, anyone making a trial can, by writing to Dr. Beck, get one of his reprints which gives full directions. His formulæ employed are as follows:

Paste for diagnosis and early treatment:

Bismuth subnitrate (arsenic-free)	30 grams.
Vaseline	60 grams.
Mix while boiling.	

Paste for late treatment:

Bismuth subnitrate	30 grams.
White wax	5 grams.
Soft paraffin	5 grams.
Vaseline	60 grams.
Mix while boiling.	

From a limited experience I should advise that Beck's method be tried in this class of cases.

Venus⁴ recommends *almatein*, a chemical compound of formaldehyde and hematoxylin. In the Vienna General Clinic it has been found to be better than iodoform and other allied drugs; it is non-toxic, reduces

¹ Journal of the American Medical Association, 1907, No. 25.

² Beiträge z. klin. Chir., 1907, xliii, 566.

³ Illinois Medical Journal, April, 1908.

⁴ Centralbl. f. Chir., 1908, xxxv, 523.

the secretion of the granulation tissue, and has been employed in all kinds of wounds, especially in burns.

Infections. In the conception of an infection, just as in a wound, we must bear in mind two results—the effect on the tissues about the infection (the local process), and the general effect (the toxic).

The local process in a *wound* is the inflammatory process, pure and simple. The general effect included under the term shock is a problem in pathological physiology, and is due to the results of hemorrhage and the effect on the nervous centres from the afferent impulses produced by the local traumatism.

The local process in an *infection* differs very little from that in a wound. In the latter it is a reaction to traumatism; in the former to bacterial irritation. The general effects of an infection are entirely different from those from an injury. They are due to the deleterious action of the toxins on the blood and the various cellular elements of the body.

For the practical purposes, therefore, of treating infections, the understanding of the inflammatory process is important for the local effects, and the principles of treatment are along the same lines as those for a wound, with one difference: on some occasions we must interfere with the local infection, not because we fear it, but on account of its general effect.

As pathological physiology aids in the conception and treatment of shock, so bacteriology holds the same relation to the general effect of an infection.

The modern experimental investigations in the domain of bacteriology are practically entirely along the lines of the general effect of the bacteria and their toxins. In the beginning of the science of bacteriology investigators were interested chiefly in the cultivation of the specific organisms of the infection. Now they are at work almost wholly on the specific effect of the now well-known organisms and how this can be combated.

Up to the present time the ideal treatment of the majority of infections is not established, as has been done in diphtheria. The antitoxin of tetanus is of value only as a preventive. It must be employed before the symptoms of tetanus develop. This is also true of the serum treatment of rabies. Every patient receiving a wound in which there is any possibility for tetanus infection should receive the antitoxin, and, according to the recent investigations of Bockenheimer,¹ all local wounds should, after thorough disinfection, be dressed daily with lipoid salves, such as balsam of Peru, or vaseline, with or without the addition of antitoxin.

Every individual bitten by an animal in which there is a possibility of rabies should have the benefit of immediate investigation as to the exact condition of the animal. The animal should not be killed, but sent at

¹ Archiv f. klin. Chir., 1908, lxxxvi, 277.

once to the Pasteur Institute, where an examination of the brain and spinal cord will allow a positive diagnosis in sufficient time to institute treatment if necessary. This knowledge should be widely disseminated among the public. Flexner has apparently, from his experimental work on monkeys, succeeded in obtaining a treatment for cerebrospinal meningitis. This disease is sufficiently prevalent to make it imperative for every practitioner to acquire the technique of lumbar puncture.¹ Only in this way can diagnosis be made, and the best results of treatment have been observed when the serum was injected into the lumbar sac.

Although, as stated before, the Utopia in the treatment of infections has not been reached, nevertheless this experimental investigation has demonstrated to a certain extent Nature's processes of combating the toxins. In the treatment, therefore, of an infection, we must know when to interfere on the local focus and understand what treatment, at least, will not restrict the natural resistance of the body, and how we can aid Nature. As concrete examples we do not interfere locally in anthrax, because it increases the danger of general dissemination; we can interfere locally only when it is possible to excise the entire area of infection by cutting through healthy tissue. We should not give alcohol to any patient suffering with an infectious disease or an infection. A small number of clinicians had come to this conclusion from their own observation. Now it has been confirmed by experimental investigation. We know why alcoholics have less resistance to infection; there is no complement in their blood. It is important, therefore, to employ means to increase this, and it can be done by the injection of horse serum. The antitoxin of diphtheria will answer, because it contains horse serum. This may explain some of the good results of certain other antitoxins which contain horse serum which have been put upon the market for the treatment of other infections.

SURGERY OF THE BLOODVESSELS.

The recent experimental work of Carrel and others on vessel suture with end-to-end and lateral anastomosis, arterial or arteriovenous, has placed this branch within the field of practical surgery. In animals almost any form of vessel anastomosis can be done successfully. With this result organs and limbs can be transplanted. At the present time the number of cases in which the practical application of this experimental work has been made is still small.

Arteriovenous anastomosis for the purpose of transfusion of blood is an accomplished fact, due to the work of Crile. It should become

¹ PROGRESSIVE MEDICINE, December, 1901, pp. 152 and 158, and December, 1905, p. 174.

the routine treatment for hemorrhage, and its field of application should be further extended as experimental investigation justifies its trial.

In previous numbers of PROGRESSIVE MEDICINE I have referred to the fact that, for the first time in its history, the *Annals of Surgery*, September, 1907, vol. xlv, has devoted practically the entire number to the surgery of the vascular system, and in the July number of this year (vol. xlviii) there are a number of original contributions to this subject.

The recent literature is very extensive, making a critical review within a short space practically impossible. All that I shall attempt to accomplish will be to indicate the articles to which one interested in this subject may refer for the details of technique, and discuss briefly for what conditions arterial suture is indicated.

The successful accomplishment of arterial suture for the transplantation of organs depends upon most careful attention to the minutest details in cleanliness and to skill in the various wrinkles of technique, best acquired by practice upon animals.

The contributions which give a history of this subject were referred to in PROGRESSIVE MEDICINE for December, 1907. They are by Watts¹ and Stich, Makkas and Dowman.²

Transplantation of Organs. This experimental work has been going on some time. Stich³ describes his experiments in transplanting kidneys and thyroids. He employs Carrel's method of end-to-end vessel suture (Figs. 1 and 2).

Vessel Suture. The most recent article on this subject is by Faykiss,⁴ a Hungarian, who, after discussing the literature, describes in detail the various methods of technique which he employed in an end-to-end suture of the divided carotid artery. This contribution, however, adds nothing to but confirms all the conclusions of Carrel.⁵ Opokin,⁶ a Russian, after giving a *resume* of the literature and describing his twenty-five experiments on animals, concludes that the following are the indications for vessel suture in man: Injury during operations, wounds of all kinds, resections of great arteries and veins when necessary to extirpate malignant tumors. Here it may be necessary to restore the continuity of the circulation in order to prevent gangrene. Vessel suture of this kind will be indicated chiefly in removing tumors from the groin and popliteal space, and in some tumors of the abdomen, where, in their removal, the circulation of the intestines may become impaired. According to Opokin the prognosis for all forms of vessel suture is better in man

¹ Johns Hopkins Hospital Bulletin, May, 1907.

² Beiträge z. klin. Chir., 1907, liii, 113.

³ Archiv f. klin. Chir., 1907, lxxxiii, 494; Centralbl. f. Chir., 1907, xxxiv, supplement, p. 10.

⁴ Centralbl. f. Chir., 1908, xxxv, 365.

⁵ Johns Hopkins Hospital Bulletin, January, 1907, xviii, 18.

⁶ Centralbl. f. Chir., 1907, xxxiv, 1009

than in animals, because perfect asepsis is less difficult (Carrel does not agree with this) and the vessels are larger.

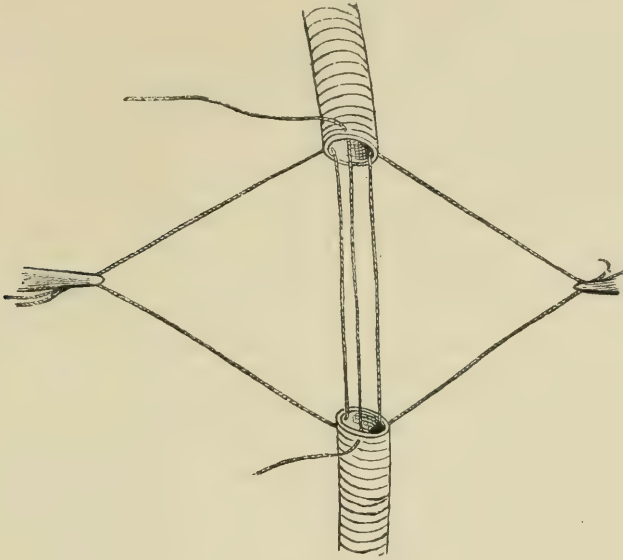


FIG. 1

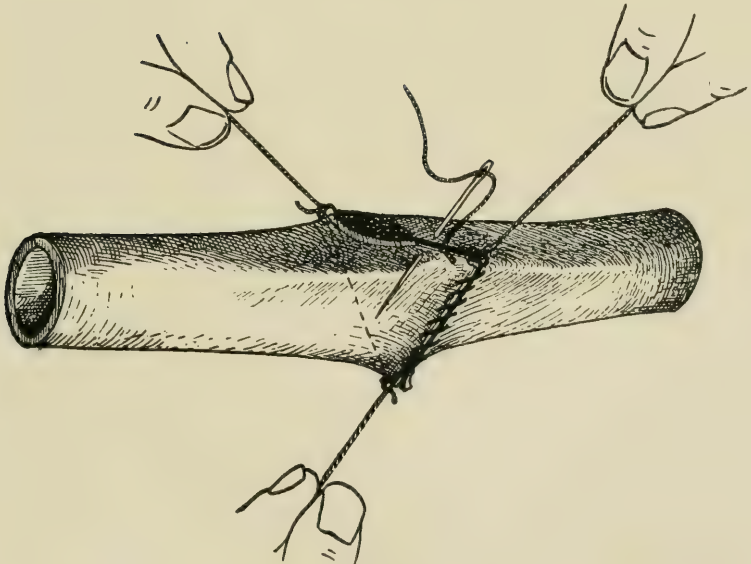


FIG. 2

Meyer¹ has performed successfully on the dog a terminolateral anastomosis between the vena cava inferior and the portal vein, thus demon-

¹ Centralbl. f. Chir., 1908, xxxv, 217

strating that, at least in animals, this is possible without any previous pressure on the vena cava for the establishment of some collateral anastomosis. The indications, of course, for such an operation are few, but now and then tumors completely or totally obstruct this large vein, and Meyer has demonstrated that the establishment of a new channel of circulation through the portal vein is possible, and has no deleterious effects on metabolism. The reverse of this operation, portal vein to vena cava, was successfully performed on a dog by Tansini, of Palermo, in 1902. The technical difficulties of anastomosing the end of the smaller portal vein laterally into the large vena cava are less than the reverse.

Draudt¹ has collected the examples of ligation and resection of the inferior vena cava. There were five successful cases. In all of these the ligature was below (inferior to) the renal vein. The experiment of Meyer may make it possible in the future to carry ligature of the inferior vena cava higher and save life by immediate anastomosis with the portal vein.

Aneurysms. This is a very large subject for a critical review, as the literature consists chiefly of reports of a single or a few cases. However, due to the establishment of a successful and safe technique of vessel suture, a new interest has been taken in the operative treatment of aneurysms. American literature has only recently taken proper cognizance of Matas' work on *aneurysmorrhaphy*. His first paper was presented before the American Surgical Association in 1902, and his further experience is published in 1905.² The last communication of Matas, in which he discussed the present status of his method of intrasaccular suture or endo-aneurysmorrhaphy, appeared in 1906.³ I refer to these communications of Matas, because if they are carefully read one can understand better the more recent article. Binnie⁴ records his experience with Matas' treatment in a popliteal aneurysm, and Abbé,⁵ in a very interesting case of aneurysm of the iliac artery. J. A. Blake⁶ reports a case presenting unusual difficulties in the application of Matas' operation. Elder⁷ presents Matas' treatment in traumatic aneurysms of the femoral artery. Frick⁸ reports a case with very good illustrations on the reconstructive method.

According to Matas there are two fundamental procedures in his method of intrasaccular suture: (1) The obliteration by suture of the vascular orifices which open into the aneurysmal sac; (2) the obliteration

¹ Deut. Zeitsch. f. Chir., 1907, lxxxviii, 109.

² Transactions of the American Surgical Association, 1905.

³ Journal of the American Medical Association, September 29, 1906, xlvii, 990.

⁴ Annals of Surgery, July, 1908, xlviii, 1.

⁵ Ibid., p. 10.

⁶ Ibid., p. 15.

⁷ Annals of Surgery, 1908, xlvii, 261.

⁸ Surgery, Gynecology, and Obstetrics, September, 1907, v, 308.

ation of the sac by suture which brings its inner surfaces in apposition, or by methods of obliteration which leave the sac undisturbed and tend to secure primary healing by plastic union. In obliterating the vascular orifices that supply the sac, the parent trunk that nourishes the aneurysm may be preserved or obliterated at the point of attachment according to the type of sac encountered, and Matas subdivides his method of endo-aneurysmorrhaphy into three varieties:

1. Obliterative endo-aneurysmorrhaphy, the fundamental procedure. Here the sac is opened without disturbing its surroundings any more than is absolutely necessary. All the arterial openings into the sac are closed by suture; the sac is then obliterated by approximating all its walls with buried sutures; when the wall is rigid the overlying skin flaps are infolded and made to line the cavity. This operation is practically equivalent to excision of the aneurysmal sac, and, of course, can only be performed in those cases in which there is collateral circulation. Aneurysms of the fusiform variety can be treated by this method.

2. Restorative endo-aneurysmorrhaphy. Here the sac is opened, the clot washed out, and the arterial opening closed by suture within the sac; the lumen of the parent artery remains patulous, and the continuity of the arterial stream is not interfered with. The single communication between the sac and artery having been closed, the sac is obliterated by suture. This method, of course, can be employed only for the sacciform type of aneurysm.

3. Reconstructive endo-aneurysmorrhaphy. This operation can be employed only in fusiform aneurysms in which the two openings leading to the main artery are on the same level and in close proximity. In addition they must be situated at the bottom of a superficial and accessible sac. In some cases the continuity of the parent artery may be restored by making a new channel in which the wall of the sac is sutured over a catheter.

Binnie¹ first gives a very good description, with illustrations, of the different forms of aneurysms, and then describes his cases in detail. His first case belongs to the reconstructive method; the aneurysm was in the popliteal space and of traumatic origin; the incision first opened a cavity filled with blood clot, which had no distinct wall; then a distinct aneurysmal sac, which communicated with the first cavity; on opening the true aneurysmal sac, two arterial openings were found quite near together; a catheter was placed into the arterial openings and then the wall of the aneurysm sutured over the catheter with catgut, the catheter being removed before the sutures were tied; the true aneurysmal sac was then obliterated, but the first cavity had to be drained. The operation was successful.

Binnie's second case was also a popliteal aneurysm, due probably to

¹ Loc. cit.

syphilitic arteriosclerosis. When the sac was opened it had ruptured in one part, and the walls were friable; in the depth there was an oval opening which had three orifices besides the one communicating with the sac; two of these communicated with the popliteal artery, and the third was a branch; the suture of the oral opening was difficult, due to the friability of the tissue, and it was impossible to completely obliterate the sac by suture. At the end of two weeks there was a recurrence of the aneurysm, and it was necessary to ligate the femoral artery; later, on account of hemorrhage, amputation had to be done. It seems to me that the failure in this case was due to the friable condition of the wall of the aneurysm and the vessel. As Binnie remarks, it came very near being a success, because for two weeks everything appeared well, and the peripheral arteries of the leg pulsated.

Abbé's case was successful. On exposing the aneurysm in the iliac fossa a temporary silk ligature was placed around the external iliac artery; the sac was opened, emptied, and completely obliterated by suture—the obliterative method of Matas.

Space forbids further discussion of this interesting subject. The pioneer work of Matas deserves the greatest credit, and with the new interest in arterial suture, and the confidence given by experimental work, it would appear that a larger number of aneurysms will be directly attacked and Matas' different procedures elaborated and made more certain.

THE TREATMENT OF ANEURYSM BY ELECTRICITY. Although there is very little literature, this procedure has its distinct indications and should be tried. The details of the method are splendidly described by Guy L. Hunner.¹ Matas,² H. A. Hare,³ and De Forest Willard⁴ have made very interesting contributions to this method. Since these communications nothing new has been added.

EXTIRPATION OF ANEURYSMS. When possible this is an ideal method, and now that arterial suture has been established the number of cases of total excision of the aneurysm will undoubtedly increase. The literature on the subject of aneurysm forms one of the most interesting fields in the history of medicine, and Köhler's⁵ contribution to the history of extirpation of aneurysms may be turned to as the most recent summary on the subject.

It is very difficult to tell before the aneurysm is exposed whether extirpation is possible, and, as surgeons become more familiar with the pathology of this lesion, I am of the opinion that they will more frequently directly attack the aneurysm and be governed by the actual

¹ Johns Hopkins Hospital Bulletin, November, 1900, xi, 263.

² Transactions of the Southern Surgical and Gynecological Association, 1900.

³ Therapeutic Gazette, 1908.

⁴ Annals of Surgery, July, 1901.

⁵ Archiv f. klin. Chir., 1906, lxxxi, 333.

condition as to the method to be followed in each case. It is to be remembered that in Matas' methods the collateral circulation is much less disturbed than in total excision. Nevertheless, in some cases excision is possible on account of the favorable relation of the aneurysmal sac to the artery. This is demonstrated in Reichel's case,¹ where there were two sacs, each the size of a fist, which communicated with the main femoral artery by a V-shaped canal. The aneurysm had followed a stab wound five years before operation. The resection was successful without injury to the femoral artery, the communication being closed by suture.

ARTERIOVENOUS ANEURYSMS. From the standpoint of a surgeon this form of aneurysm has added interest. To treat these lesions successfully one must be familiar with what has been done with collateral circulation, and have a knowledge of the usual result after the ligation of special arteries and veins. The decision when to operate, if the case is seen in the recent state, is an important one. Now that we can fearlessly suture arteries or veins, perform lateral or end-to-end anastomoses, and restore the continuity of vessels by the substitution of a resected vein or artery, the field in the operative treatment of arteriovenous aneurysm will be increased. Yet up to the present time there are few cases. Lexer's² original communication has been published since I referred to its abstract as read at last year's German Surgical Congress.³

Lexer's successful accomplishment was an operation upon a traumatic arteriovenous aneurysm in the popliteal space. The operation was performed eight weeks after the stab injury. It was necessary to excise the sac and resect 5 cm. of both artery and vein. An end-to-end anastomosis was performed over a thin, soluble magnesium prothesis recommended from the experimental work of Payr. In view of the shortening of the vessels, after closure of the external wound, the leg was placed in plaster at right angle for four weeks. At this time an *x*-ray showed no trace of the prothesis. The patient was allowed to walk at the end of six weeks, and gradually the leg was extended. At the present time, nine months after operation, Lexer finds that the peripheral pulse is weaker than when the patient left the hospital. In other respects there have been absolutely no symptoms, except an anesthesia and paralysis in the distribution of the peroneal nerve. The deep, soft-part scar in the popliteal space has increased in thickness. Lexer attributes this to the excessive inflammatory process excited by the constant pull of extension from the position of flexion in which the wound healed. He does not think that there is any special narrowing of the lumen, although he is inclined to the opinion that end-to-end anasto-

¹ Centralbl. f. Chir., 1907, xxxiv, supplement p. 116.

² Archiv f. klin. Chir., 1907, lxxxiii, 459.

³ PROGRESSIVE MEDICINE, December 1907, p. 140.

mosis with a prothesis is more apt to heal with an excessive inflammatory production than without a prothesis. He has advised this patient to have the soft-part scar excised with the hope of relieving pressure from it. It is my opinion that it would be better for Lexer to wait a little longer, as absorption may take place spontaneously. It is hard to imagine that this soft-part scar is not adherent to the vessel, and in completely excising it there would be risk of injury.

This case of Lexer is a very important one, and each year it will become of greater interest. It will require time to establish what happens after the various methods of vessel suture in regard to subsequent narrowing of the lumen. At the present time experimental work on animals emphatically favors suture without prothesis, and from my limited experience I believe it is just as easily accomplished without any mechanical device. In an arteriovenous anastomosis for the transfusion of blood, where time is important and the vessels are afterward severed, a mechanical device, like that of Crile for temporary anastomosis, can be used. In Lexer's second case it is unfortunate that the patient died from a complication, because the defect in the axillary artery of 8 cm. was filled with a piece of the long saphenous vein. The autopsy demonstrated a successful suture, but the artery above was thrombosed, due, Lexer thinks, to clamping it too firmly.

Further experience on animals and man will establish the refinements in technique. It is a good thing for surgery that there are still unexplored fields and operations with difficult technique. With modern methods of cleanliness, too many surgical operations can be performed with such ease and simplicity that it encourages poorly equipped men to enter the field, who fear not, on many occasions, to do what wiser and more experienced surgeons shrink from. Nothing is better for the progress of surgery than an increase in its demands that those entering its field must be properly equipped not only with knowledge, but with the necessary skill.

Before Lexer's successful operation there had been very few others. Zöge von Manteuffel, in operating upon an arteriovenous aneurysm in the region of the deep branch of the femoral, injured the main femoral artery during the dissection, but saved his patient and the limb by a lateral suture of the artery, which, according to Lexer, is the first case on record. Perhaps this case does not belong among the successful operations for arteriovenous aneurysms treated by vessel suture, but it had its good effect, nevertheless. Murphy, of Chicago, records the first successful case in 1896, in which, after the removal of the arteriovenous aneurysm with 9 mm. of the artery and vein, end-to-end anastomosis of both vessels was performed by his method of invagination. The case differs from Lexer's in that the operation was performed early—eighteen days after injury—before a sac had formed.

Murphy's monograph, reporting this case and his experimental work

on resection of arteries and veins with end-to-end suture, should be read by every surgeon.¹ At the present time his method of invagination has been given up for end-to-end suture, but I am inclined to the opinion that his method should not be lost sight of, as it may become necessary in certain cases.

Murphy's First Case. The patient, a male, aged thirty-three years, received a bullet wound (22 caliber) in the left Scarpa's triangle. He was seen by Dr. Murphy four hours after the injury. The operation was performed at once, and a lateral tear in the internal saphenous vein near the vein branch, and another in the femoral vein itself near this branch, were found and sutured successfully. At the operation the femoral artery showed a fragment of tissue torn from its sheath; the wall apparently was not injured. Later, the wound had to be opened on account of infection. There was secondary hemorrhage about thirty days after operation, apparently from suppuration of sutures in the vein. When the vessels were explored a few days later it was found that the femoral artery had a number of openings into it, and it was necessary to resect and ligate the artery, but apparently the femoral vein was all right. The patient recovered with a good limb.

I mention this case as an example of the difficulties that may be encountered when the operation is performed in the recent state. Of course, such an operation becomes imperative if the hemorrhage cannot be checked, or if the circulation of the limb is threatened by the increasing hematoma. If these two factors are absent, it seems wiser, perhaps, to delay, but this point is by no means settled.

Murphy's Second Case. A bullet wound in Scarpa's triangle in a male, aged twenty-nine years, was first observed two hours after the accident. There were no indications for immediate operation. The patient was observed by Dr. Murphy about fifteen days after the accident. At this time there was a bruit, but no tumor and no pulsation in the peripheral vessels. The region of the injury was exposed three days later; the femoral artery was bared below Poupart's ligament and fixed with a provisional ligature, which, however, was not tied; from this point down the artery was carefully dissected free and clamped on either side of the injury; now there was profuse hemorrhage from the vein. There was a small cavity posterior to the artery and another anterior to it, somewhat like in Reichel's case just discussed. The hemorrhage from the vein was controlled by digital compression. On account of the injury to the artery it was necessary to resect and do an end-to-end suture; a lateral suture closed the opening in the vein. Apparently this case has gotten into the literature as double resection of the vein and artery, while from the original, which I have before me, it was only the artery that was resected and sutured.

¹ Medical Record, January 16, 1897

Körte, in 1904, performed lateral suture of the popliteal artery and vein thirty-two days after an injury, while Garré operated upon his patient ten years after the injury, excised the sac and a piece of vein, closed the lateral opening in the artery by suture, and performed lateral suture on the vein.

Murphy was, therefore, the first to successfully resect the artery and perform end-to-end anastomosis, while Lexer is the first to successfully accomplish it on both artery and vein.

The condition of surgery of traumatic arteriovenous aneurysm up to 1902 will be found in the monograph of Matas.¹

THE ESTIMATION OF THE COLLATERAL CIRCULATION BEFORE OPERATION FOR ANEURYSM. Von Oppel,² in his paper, not only brings out an important new point first established by Korotkow, but gives a very interesting discussion of the modern treatment of arteriovenous aneurysm.

The numerous arteriovenous aneurysms observed by well-trained surgeons after the Russo-Japanese war have given additional and most instructive information in this field of surgery.

Korotkow has demonstrated that if one compresses the artery above the aneurysm the blood pressure below will indicate whether this artery can be ligated without consequent gangrene of the limb. If the artery is compressed above and below the record of the blood pressure peripherally will indicate or contra-indicate excision.

According to von Oppel, the most important point in the operative treatment of arteriovenous aneurysm is to check the mixing of arterial and venous blood. Although simple ligation of the artery above was the method of choice for older surgeons, today it is the method with the greatest danger of gangrene. The ligation of the artery above and below the sac will not be successful and will probably result in gangrene if there are collateral branches between the ligatures. The older method of Antillus, which was less frequently performed before on account of the danger of sepsis, now becomes the method of choice. When the circulation can be controlled by an Esmarch, the sac is opened and all the communicating branches tied. When this is impossible the artery and vein above are first exposed and tied, then the sac is opened and the other communicating branches tied—a method, therefore, modernized by Matas. Excision of the sac should not be performed unless it is small and easily separated.

When the study of the collateral circulation demonstrates that it is insufficient, then, in the operative treatment, there must be restoration by arterial suture at least of the artery, and in some instances also of the vein.

The collateral circulation, therefore, should be carefully studied be-

¹ Journal of the American Medical Association, January 11, 1902.

² Archiv f. klin. Chir., 1908, lxxxvi, 31.

fore operation; but now, even though there be not sufficient collateral circulation, surgeons should not hesitate in properly selected cases to cure the aneurysm by the ideal method of suture.

Von Oppel states that Matas, before Körte, Lexer, and Garré, successfully performed arterial suture for arteriovenous aneurysm, but I cannot find the case in Matas' publications.

According to a letter from Dr. Matas, dated July 25, he has had two cases of arteriovenous aneurysm in which attempts were made to restore the continuity of the circulation in each vessel by separating the vascular anastomoses and suturing. In the first case, some years ago, the venous suture was successful, but the artery had to be ligated; in the second, a recent and unpublished case, both the venous and arterial suture were successful. Von Oppel, therefore, is not correct; Matas was only among the first to perform successful venous suture for arteriovenous aneurysm.

Dr. Matas was also good enough to send me his paper, read before the Surgical Section of the American Medical Association, June 3, 1908 (not yet published), in which he reports 85 operations by fifty-two surgeons, of which 77 were typical operations. Among these 85 cases, 18 were of the femoral artery and 50 of the popliteal; 5 of the ileofemoral; abdominal aorta, subclavian, brachial, each 2; external iliac, gluteal, posterior tibial, external carotid, subclavio-axillary, each 1.

Mitchell, of Washington, sends me his manuscript, as yet unpublished, in which, in reporting a very successful operation for arteriovenous aneurysm, he discusses the literature of Matas' operation. The case operated on by Mitchell resembles very closely that of Frazier.¹ The aneurysm was of the femoral artery immediately below Poupart's ligament. At the operation, first the external iliac artery was exposed and two provisional silk ligatures passed around it, but not tied. The circulation of the artery was occluded by a piece of tape held by an assistant. After opening the sac and wiping out some clots there was immediately a profuse hemorrhage, in spite of the absolute obliteration of the external iliac artery. The hemorrhage was first controlled by gauze packing. As the gauze was cautiously removed the operator was able to see and plug successfully with the fingers of the left hand the openings into the sac of five arterial branches; the largest one was apparently the deep femoral. Each one of these openings was closed from within the sac with a continuous catgut suture, and now, when the tape ligature on the external iliac was released, there was no hemorrhage. The sac was then completely obliterated according to Matas' method. The operation, although a very difficult one, was entirely successful, and when the patient was examined about one year later the result was still apparently excellent.

¹ *Annals of Surgery*, September, 1907

LIGATION OF ARTERIES. Although at the present time, for aneurysm, injury, and other conditions, surgeons less frequently resort to ligation, yet it is a very important matter for one to have exact knowledge as to what will happen after the ligation of large vessels, and for this reason I give a summary of the splendid work of Offergeld.¹

As a matter of principle, if there is any danger of gangrene, one should make an attempt to restore the continuity of the large vessels by suture in all cases.

The results of Offergeld's work is summarized by him briefly as follows:

1. After the ligation of any one of the large vessels of the hypogastrium a collateral circulation is very quickly accomplished, the real routes of compensation of which are small vessels of the size of capillaries. The evidence of this is:

(a) The characteristic condition of the blood pressure before and after ligation, and the space of time required for the restoration of the original pressure.

(b) The injection of the vascular system with subsequent x-raying and preparation.

2. These compensatory routes offer, on account of the narrowness of their lumen, much greater resistance to the circulating blood than the vessel before ligation, thus entailing increased demands upon the activity of the heart, which can be demonstrated both clinically and anatomically:

(a) The clinical symptoms are: broadening of the area of cardiac dulness, especially to the left; raising apex impulse, sharpening of the first note at the apex, accentuation of the second aortic and sometimes also of the second pulmonic note, rise of the blood pressure in the carotid by several millimeters.

(b) The anatomical changes consist of concentric hypertrophy of the myocardium, depending in extent upon the size of the ligated vessel, and trabecular arrangement of the fibers.

When the heart is unable to cope with the increased demands upon it, severe symptoms of insufficiency become manifest; clinically, there are cyanosis, dyspnea, edema, and stasis; pathologically, one finds a more or less distinct dilatation of the heart, especially involving the left ventricle, stasis in the large glands of the hypogastrium; occasionally also some ascites, infarcts, and edema of the lungs.

3. Since the increased pressure has an acute onset and the greater demands upon the heart are rather sudden, cases in which the vessels have become gradually compressed by tumors, or obliterated by thrombi, cannot be utilized in estimating the consequences of ligation.

4. The condition of the heart and the increase of pressure determine the result of the ligation.

¹ Deut. Zeitschr. f. Chir., 1907, lxxxviii, 217.

5. The blood retained in the excluded portion of the vessel is gradually absorbed; the vessel itself becomes thrombosed according to the well-known laws, likewise the ligated portion.

With regard to the single vessels, the following can be noted:

6. The *ligation of the aorta* makes such enormous demands upon the action of the heart that the latter in most cases very soon becomes insufficient; it is therefore absolutely out of question in diseases of the vessels (aneurysms), in septic and constitutional diseases; whether it would be available in acute anemia as a last resort is an open question; perfectly healthy circulatory organs are indispensable for the success of the operation (postpartum hemorrhage).

The paralyzes occurring after ligation of the aorta are peripheral in character; this is proved by the following:

(a) Examination of the spinal cord.

(b) Results of electric examination.

(c) Same condition after increased excitation in the spinal cord.

(d) The fact that ligation of the common iliac artery causes the same phenomena.

The blood pressure in the femoral artery falls almost to the abscissa, and requires several days to return to its original height. The stabbed artery only runs out without squirting; pulsation only returns with almost normal blood pressure.

7. Bilateral ligation of the *common iliac artery* gives the same phenomena as that of the aorta; the unilateral ligation is not very dangerous; here, too, the blood pressure falls to almost zero in the femoral; pulsation is only restored on the next day; the excitability of the muscles for both currents does not approach normal until twenty-four hours later.

8. The ligation of the *internal iliac artery*, even on both sides, is not a dangerous intervention; collaterals form very quickly; the increase in pressure is very slight, so that the trabecular arrangement of the muscle fibers in the heart is never present, and in most cases there is also no trace of a hypertrophy.

9. The extraperitoneal ligation of the *external iliac artery* is not dangerous; even after bilateral operation there is no considerable increase in pressure in the arterial system; the collaterals begin to act promptly, so that gangrene of the extremity need not be apprehended. Clinically, increased heart action is manifested by accentuation of its notes; anatomically, occasional slight hypertrophy is found.

10. In the *femoral artery* conditions in man differ from those in the experiment. Its ligation in man is very dangerous, because in almost 60 per cent. of the cases it is followed by *gangrene of the extremity*—a complication which, while possible in animals, is yet extremely rare. The pulsation in the peripheral part is only restored in two days, the original pressure only in two to three days; the same time is required

for the restoration of normal electric excitability. On account of this danger of gangrene of the limb, ligation of the corresponding common iliac artery is preferable.

11. Ligation of the *femoral vein* causes some pareses in the limb, but no edema and no gross disturbances in the sensibility. Increase in blood pressure, even in bilateral ligation, is but slight; there are no changes in the heart.

12. The extraperitoneal ligation of the *external iliac vein* causes no changes and no symptoms in the limb; edema as well as permanent, motoric, and sensible disturbances are absent altogether. The collateral veins quickly assume function, and, although they are inserted capillaries, no changes in the heart result; the rise in the arterial system is but insignificant and passes quickly.

13. The ligation of the *internal iliac vein* at one place only is not a dangerous operation; the collaterals very soon assume ample function; the bilateral ligation is, as a rule, also stood without trouble, yet bladder symptoms may occur; there is no very great rise in the pressure; heart changes are absent altogether.

14. The unilateral ligation of the *common iliac vein* causes no noteworthy phenomena; edema is absent; the collaterals assume function quite rapidly, so that restoration takes place in twenty-four hours. The rise in blood pressure is not considerable. Bilateral ligation causes the same symptoms and changes as

15. The ligation of the *inferior cava* below the anastomoses of the renal veins producing no disturbances in the organs of the pelvis and the extremities; edema is absent; motor and sensory symptoms pass rapidly; clinically, symptoms of increased demands upon the circulation can be demonstrated; broadening of cardiac dulness, displacement of the apex beat, accentuation of the heart notes, and increased pressure in the carotid; anatomically, one finds concentric hypertrophy, especially of the left ventricle; all these symptoms are by far not as distinct as after ligation of the aorta. The original pressure is restored on the second day.

16. The acute rise in pressure must be considered in every case as the most important factor in the direct result of the operation, for as to the success it is immaterial whether ligation is done on a moderately sized and a small vessel or several small ones.

ARTERIOTOMY FOR THROMBOSIS AND EMBOLISM. When circulation of the limb is threatened by thrombosis or embolism, it is now justifiable to cut down upon the artery, open it and turn out the clot, and then to suture the defect. Stewart¹ reports two cases: The first patient was a male, aged sixty years; he was admitted to the Pennsylvania Hospital, June 20, 1905, after contusion of the lower left abdomen and the

¹ Annals of Surgery, September, 1907, lxvi, 339.

upper left thigh; at the time of admission the pulsation of the tibial vessels was as strong on the left as on the right side. Twelve hours after injury the patient complained of severe pain, first in the popliteal space and then radiating down the leg into the foot and toe. At the examination, a few hours later, there was no pulsation of the tibial and popliteal arteries of the left leg; the femoral could not be palpated on that side because of the swelling secondary to the contusion. The pain had now disappeared and the limb as far as the knee was pale and cold. Sensation was reduced in the foot and leg. The patient was unable to move the toes and with difficulty flexed the ankle. Movements of the limb at the knee-joint were not impaired. The leg above the knee was warm.

A diagnosis of thrombosis or embolism at the popliteal artery was made. The popliteal artery was exposed by incision twelve hours after the onset of pain. On opening the artery by a small longitudinal incision, some dark blood flowed out, but there was no clot; a probe passed for six inches could find no obstruction, and was not followed by any flow of blood. This wound was then closed, and the femoral artery from above Poupart's ligament downward was dissected; it was found that the sartorius muscle had been ruptured. The femoral vein was uninjured; the femoral artery felt hard. After dividing Poupart's ligament and compressing the pulsating iliac above the thrombosed femoral the artery was opened and a dark adherent clot exposed. This clot was adherent to a calcified patch on the intima. After removing the calcified plate and the clot the compression of the iliac artery above was slightly diminished to allow a flow of blood sufficient to wash away the debris; then the arterial wound was sutured. For a short time tibial pulsation returned and then ceased. The wound in the artery was reopened and a blood clot again found and removed. The same phenomenon was repeated. Finding that thrombosis recurred in this injured and diseased segment, a resection of this area was performed with end-to-end suture; again the circulation was reestablished, unfortunately to cease again. Gangrene followed, and ten days later it was necessary to amputate. This patient had general arteriosclerosis. The difficulty, therefore, in this case was due to the condition of the intima, probably the result of the contusion which led to recurrent thrombosis, and, as Stewart in his discussion says, in the future in such cases one must excise more of the artery, and, if end-to-end suture is then impossible, substitute a piece of vein.

The second patient was a male, aged sixty-one years, with marked arteriosclerosis. Illness began with abdominal pain, perhaps abdominal angina. Five days after recovery from this illness the patient was seized with sudden severe pain in the right foot, and then followed rapidly all the early symptoms and signs of gangrene. The femoral artery was exposed thirty-six hours after the onset of pain; pulsation

was present to within one inch of the bifurcation; there the artery was hard, below the bifurcation collapsed. On opening the artery a Y-shaped thrombus was found extending into the superficial and deep femoral. The clot was dirty white, with red and black blotches. On removing the thrombus blood flowed freely, except from the peripheral part of the superficial femoral. After closing the artery and the wound, pulsation returned below in the femoral and popliteal, but not in the tibial vessels. After the third day the pulsation in the tibial grew weaker and disappeared on the eighth day. Symptoms of gangrene followed, and the leg had to be amputated below the knee forty-two days after the operation, in spite of definite evidence of collateral circulation. At the amputation the popliteal artery contained a small clot.

Although these two operations were not successful in saving the limb from gangrene, they nevertheless demonstrated the feasibility of arteriotomy. According to Stewart, Lejars, in 1892, removed a thrombus from the femoral artery;¹ the thrombosis was secondary to contusion, and the operation was not performed until six days after the accident, at which time gangrene was present. Sabanajew,² in 1896, exposed the femoral artery, but did not find the clot; in his case the gangrene was associated with polyarthritis, and when the sudden signs of its presence appeared, Sabanajew thought it was due to an embolus. Unfortunately there was no autopsy on the patient.

The most remarkable attempt at arteriotomy has been suggested and performed first on an animal and then on man by Trendelenburg. A not infrequent cause of death is thrombosis or embolism of the pulmonary artery, and Trendelenburg was of the opinion that exposure of this artery and removal of the clot was a feasible and justifiable procedure. The technique belongs to surgery of the chest, but up to the present time it represents the most daring procedure in surgery of the bloodvessels. However, when we glance at what has been accomplished in suture of wounds of the heart this operation is no more serious. Both conditions—thrombosis of the pulmonary artery and wounds of the heart—are fatal. Any procedure, therefore, that promises any hope is justifiable. In the first communication³ Trendelenburg describes his experiments on animals to establish the technique, and one unsuccessful case in which the operation was complicated by pericardial adhesions. In the second communication⁴ he describes a successful removal of the embolus from the pulmonary artery of a calf. The clot was introduced into the circulation through the jugular. In this case the artery was opened, while in his previous experiments the clot was removed through an opening in the heart by means of an aspirating syringe. In the third communication⁵ Sievers, in Trendelen-

¹ Bull. et mém. de la Soc. de Chir. de Paris, 1902, p. 609.

² Höpfner, Archiv f. klin. Chir., 1903, lxx, 417.

³ Centralbl. f. Chir., 1907, xxxiv, 1302.

⁴ Ibid., 1908, xxxv, 282

⁵ Deut. Zeitschr. f. Chir., 1908, xciii, 282.

burg's clinic, reports an almost successful intervention on a human being. The pulmonary artery was exposed within twenty minutes after the first symptom, and the two large clots removed (Fig. 3). The patient lived fifteen hours. The partial autopsy demonstrated a patent artery, and the pneumothorax had disappeared.

Handley's case is an example of a desperate attempt to free the thrombosed femoral artery.¹ The complication occurred twenty-four hours after an operation for strangulated hernia in a male, aged sixty-five years. The complete absence of pulsation in the femoral urged Handley to attempt anything rather than amputation. His scheme was very much like that of Trendelenburg, who, in his first operations, tried



FIG. 3

to get the clot in the pulmonary artery by aspiration through an incision in the heart. Handley washed out the femoral artery by introducing a catheter first into the external circumflex branch and then into the deep femoral; he was only partially successful; the critical condition of the patient necessitated termination of the operation. The patient did not recover. The autopsy demonstrated a clot in the left auricle and an embolus in the left common iliac. It seems to me that in view

¹ British Medical Journal, September 21, 1907; review in *Centralbl. f. Chir.*, 1908, xxxv, 53.

of the absence of pulsation in the femoral, as far as it could be palpated, it would have been better technique to have exposed the iliac above Poupart's. I have had an apparently similar, but more fortunate, experience. There was every evidence of a thrombosis or embolism in the common iliac artery, but, as the patient's condition when first seen was entirely too critical for anesthesia, I attempted to dislodge the clot by massage, and, to my astonishment, succeeded.

The patient was a woman over fifty years, convalescing from a simple hysterectomy for cancer of the uterus. The only complication was due to the fact that she was very stout, and the operation had been a difficult one. The uterus was small, however, and there were no adhesions; the cancer was a very early one. The operation had been performed by my colleague, Dr. Kelly. About two weeks after operation the patient was taken with agonizing pain in the left lower limb, which immediately became cold and numb. When I saw the patient, about four hours after the onset, she was moaning with pain, restless, and in shock; the pulse was rapid and feeble; respiration shallow and slow; the face pale and covered with cold perspiration; the left limb was not swollen, but cold, almost anesthetic, and the patient was unable to move it. The color of the skin was peculiar—a blotched, bluish hyperemia. I could not get pulsation at the foot, in the popliteal space, nor above or below Poupart's. The picture, therefore, was that of an embolus or thrombosis of the common iliac. It seemed to me that anesthesia and an operation on so stout a person was, at least for the time, contra-indicated.

My idea was to try to keep up the circulation of the limb until the patient's condition was better. The shock was undoubtedly due to the intense pain and fright. She was given morphine, the foot of the bed was elevated, salt and coffee were given per rectum, and a subcutaneous infusion started. The morphine did not relieve the pain. I tried to relieve the fear by positive statements to the patient that the discoloration of the limb was but a temporary affair and would soon disappear. The left limb was then elevated to an obtuse angle at the hip, extended at the knee; to my surprise I found that when I began massage at the ankle and extended it up to the thigh, I could momentarily get rid of the bluish tint, which apparently, therefore, was due to venous stasis. With the assistance of Dr. Buckler and a number of nurses this massage was kept up. While this was being done I began deep palpation in the left iliac fossa over the iliac artery, stroking toward Poupart's ligament. My intention at that time was to dislodge the clot to a point lower down in the femoral artery, which would reduce the extent of the gangrene and simplify the arterial exposure. It never occurred to me that I could do more than get the clot into the femoral artery. Suddenly I felt the artery below Poupart's ligament, not as a pulsating tube, but as a thin, long, solid tube. This was confirmed by Dr. Buckler.

Further massage was followed by the appearance of pulsation below Poupart's and disappearance of the palpable cord. Palpation of the lower portion of the thigh, on account of the thickness of the subcutaneous fat, could not be expected to make out the artery.

The moment I felt pulsation at Poupart's ligament, which was about two hours after I first saw the patient, she said that the pain was gone, and for the first time she became quiet and closed her eyes in an attempt to sleep. Now, when the massage was discontinued, it was at least five minutes before the discoloration re-appeared, and it then only extended to the knee. I persisted in my manipulations along the artery, while the nurses continued the superficial massage of the entire limb. At the end of one hour more feeling returned to the foot, the limb became warm, and there was practically no discoloration when massage was discontinued for about fifteen minutes, but I could not get pulsation in the popliteal or the tibial. As I was unable to make out pulsation in the opposite popliteal, I concluded that this was prevented by the thickness of the subcutaneous fat. About six hours after the beginning of the treatment pulsation in the tibial vessels was distinctly made out, and, except for a patch the size of a silver dollar here and there on the limb, there was no discoloration. From now on the massage was continued at intervals of two, increased to four, hours for two days. There was never any further evidence of impaired circulation; the patches disappeared in two to three days. I thought at first that they might result in superficial gangrene. In the recovery, for at least five days, the kidney secretion was scanty. The patient was able to leave the hospital in about three weeks. There have been no further symptoms of impaired circulation.

I have seen one case of thrombosis of the abdominal aorta, confirmed by autopsy, thirty-six hours after onset, in which the discoloration of both lower limbs in the beginning resembled the discoloration of the limb in this case. In fact, all the symptoms of both cases in the first few hours after the onset were identical. For this reason it seems to me that I am justified in assuming the presence of a thrombus or embolism in the iliac artery which was dislodged by manipulation.

Moynihan¹ successfully removed an embolism from the popliteal artery, but the patient died four days later of pulmonary embolism, and the autopsy demonstrated marked endocarditis and infarcts in the lung.

I have two specimens in the surgical pathological laboratory of the Johns Hopkins Hospital, of lower extremities amputated in the thigh for gangrene. In both there is but a single embolus plugging the popliteal artery at its bifurcation. Arteriotomy and removal would have been a simple procedure, and as one of these patients recovered from the amputation, it is fair to assume that his limb could have been saved.

¹ British Medical Journal, September 28, 1907.

The other patient died some days after the operation with symptoms of embolism of the coronary artery.

Gangrene and Arteriosclerosis. The most interesting point in regard to gangrene of the fingers (Figs. 4 and 5), toes, and of the extremities



FIG. 4



FIG. 5

FIGS. 4 and 5.—Male, aged fifty-eight years; diabetes twelve years; marked general arteriosclerosis; gangrene after infection of the finger ten days ago; amputation with head of metacarpal bone. Recovery.

are the early symptoms, before the stage of gangrene, because the recognition of the disease at this stage can, by appropriate preventive treatment, lead to its arrest.

In view of the scanty literature, I have not discussed the subject of gangrene since 1904. Since then there has been very little of importance published.

HYPEREMIA IN THE TREATMENT OF GANGRENE AND FOR DIAGNOSTIC PURPOSES. Röpke¹ recommends active hyperemia, accomplished by hot lysol baths, in gangrene. In his patient, after removal of the toe for gangrene, the process began to extend up the foot; the hot applications produced active hyperemia, checked the gangrenous process, and aided healing. The reviewer Kramer has had good results from hot-air treatment. This treatment should always be tried the moment gangrene appears in the toes or fingers. Its success, of course, will depend on the condition of the vessels. It may not always be successful, but there is no doubt that these hot applications increase the circulation and stimulate the collateral circulation.

Moskowitz² employs the Esmarch bandage to indicate the plane of amputation in cases of gangrene. In a healthy man, after the removal of the Esmarch which has been placed on the extremity, as for a bloodless operation, the sudden return of the circulation is associated with vasodilatation and erythema of the skin. In Moskowitz's three cases of gangrene, after he removed the Esmarch, which had been on five minutes, this erythema ceased at a certain level above the toe, differing in each case. He selected this point as the place for amputation, which in each instance was correct as confirmed by an examination of the specimen and the ultimate result of the operation.

INTERMITTENT LIMPING AS AN EARLY SIGN OF GANGRENE. I have discussed this previously. Muskat³ again refers to it and calls attention to the fact that veterinary surgeons have made similar observations upon horses in which later thrombosis of the vessels took place. With this sign one should also take an *x-ray* picture, and quite frequently the marked arteriosclerosis will be portrayed.

From my own accumulated experience the prognosis is pretty good. For example, in looking over my cases in which I have removed one or more toes for arteriosclerotic gangrene, the majority associated with glycosuria, I find that these patients under appropriate treatment have up to the present time lived from five to twelve years without further gangrene. In one case, during a period of ten years, I removed, from time to time, in all, six toes. In the treatment, diet and hygienic life play a very important part. I have also recommended my patients to take hot baths twice a day, use massage, and avoid active exercise.

¹ Centralbl. f. Chir., 1907, xxvii, 859.

² Mitteilungen aus den Grenzgebieten der Medizin und Chirurgie, 1907, xvii, 216.

³ Centralbl. f. Chir., 1908, xxxiv, 491.

THE QUESTION AS TO THE PLANE OF AMPUTATION IN GANGRENE. Willmanns,¹ after a study of 174 cases of spontaneous, senile, and diabetic gangrene, gives his conclusions as to the method of selecting the place to amputate, chiefly between below and above the knee. He is not familiar with Moskowicz's test, and is of the opinion that the presence or absence of pulsation in the popliteal artery should not influence one, because its absence with collateral circulation will allow a lower amputation than its presence without it, and in addition the circulation is very much influenced by the presence or absence of venous thrombosis. He makes a good point, however, when he states that if the line of the demarcation forms rapidly and sharply, amputate below; if slowly, indefinitely, or not at all, amputate high. On the whole he advises conservatism.

SPONTANEOUS GANGRENE IN YOUTHFUL INDIVIDUALS, PRESENILE GANGRENE. This subject, which belongs to the surgery of the extremity and includes the study of juvenile arteriosclerosis, I² presented with some detail in 1901. Hirschel³ discusses the literature up to 1906, in reporting some of his own observations, but adds nothing new to the subject.

GANGRENE IN YOUTH AFTER INFECTIOUS DISEASES. Barraud⁴ has written a monograph, with 180 references to the literature and tabulates 103 cases. Typhoid fever ranks first, with 44 cases; typhus second, with 11 cases; puerperal infection comes third, with 9 cases. The remaining 18 infectious diseases are credited with from 1 to 6 examples. Malaria presents only two observations; the instance which I have reported with illustrations, in *PROGRESSIVE MEDICINE*, December, 1900, p. 130, is not included. This complication, therefore, of an infectious disease is rare. The majority of instances are observed in the second and third week of the infection; there are very few after the eighth week, but during convalescence, especially from typhoid, gangrene has been observed. The gangrene is most common in the lower extremity.

The symptoms described by Barraud do not differ from the classic picture. Acute, sudden pain is the symptom of onset; rarely do the symptoms begin slowly and insidiously, and, in spite of the anesthesia which rapidly appears, pain does not cease until the line of demarcation has formed. The patient complains of formication and coldness of the skin, which is first pale and then red. If the veins are involved there is swelling and edema of the extremity. The most characteristic early symptom is absence of pulsation in the peripheral arteries, which can be felt as painful cords. The typical feature of gangrene usually begins in a few days. The diagnosis should not be very difficult. It can be distinguished from phlebitis by the absence of pulsation. The prog-

¹ Beiträge z. klin. Chir., 1907, lv, 556; Centralbl. f. Chir., 1908, xxxv, 411.

² *PROGRESSIVE MEDICINE*, December, 1901, p. 200.

³ Beiträge z. klin. Chir., 1906, lii, 182.

⁴ Deut. Zeitschr. f. Chir., 1905, lxxiv, 234.

nosis is bad. In this list of cases the mortality has been about 50 per cent., which is about the same in the different forms of gangrene. As this list contains all cases, old and new, the probabilities are that under modern treatment the mortality would be slightly less.

Barraud does not discuss preventive treatment, but, in view of what we have already said, sudden pain in the extremities should be looked upon as a symptom suggesting thrombosis; immediately there should be blood-pressure examinations and careful palpation of the peripheral artery; the leg should be elevated and kept in hot applications, or in hot-air apparatus; if the veins are not involved, massage is not contra-indicated; when positive signs of gangrene appear, an application of the Esmarch should be made to estimate, if possible, the probable line of demarcation. This, I am confident, will allow earlier amputation, with better results. From the pathological findings it would appear that there are some cases in which arteriotomy and removal of the thrombus from the artery might save the leg, and I would suggest, when gangrene threatens, pulsation is absent, and the examination with the Esmarch has been made, that before proceeding with amputation one should expose the artery and see if it is possible to remove the clot. In our discussion of surgery of the arteries it has been demonstrated that such operations are justifiable.

In Vol. II of Osler's *Modern Medicine*¹ gangrene as a complication of infectious disease is mentioned under practically every infectious disease. After typhoid it is stated that it is not common. Keen's monograph is referred to, which includes 133 collected cases. This collection, however, includes superficial gangrene of the skin, *bedsores*, as well as that associated with thrombosis or embolism of arteries. Thrombosis is more common, and is rarely associated with venous thrombosis, while venous thrombosis or phlebitis, especially of the lower limb, is a much more common complication of typhoid than extensive involvement of the arteries with gangrene. It is rather interesting to note that in Vol. I of the same text-book, in the extensive article on malaria, by Craig, the complication of gangrene is not mentioned, although the case I reported was also seen by the editor, Dr. Osler.

DIABETIC GANGRENE AND OPERATIONS IN THE PRESENCE OF GLYCOSURIA. In *PROGRESSIVE MEDICINE* for December, 1901, pp. 188 to 200, I gave this subject considerable attention. Since then I find in the monograph of Karewski,² the best and most practical statement of the questions of interest to surgeons. It is first to be remembered that after operations on diabetic patients or those suffering with glycosuria, there are no peculiar symptoms or complications which might not occur without an operation.

¹ Lea & Febiger, 1907.

² Berl. klin. Wochenschr., 1905, Nrs. 10-12; review in *Centralbl. f. Chir.*, 1905 xxxii, 596.

General anesthesia may be looked upon as contra-indicated unless the operation is strictly necessary. Nevertheless, the danger of anesthesia is not particularly great, and has been exaggerated. One must also bear in mind that in many cases the operation removes a factor more dangerous to the patient than the intervention. Second, we must recollect that apparently diabetic patients have less local and general resistance to infection than healthy individuals. As a matter of prognosis the outlook is better for a patient in good condition with a high percentage of sugar than one in poor condition with a low percentage. Therefore, in diabetic patients the indication for operation should be studied more critically, and all the usual precautions as to anesthesia and asepsis more carefully supervised. If possible they should have a preliminary dietetic treatment. In abdominal cases the usual cleaning out of the intestines and preliminary starvation emphatically should be eliminated. Diabetic patients do not stand sudden starvation. They should have before and after operation, large quantities of water containing alkalies. In any operation the toxins of the anesthetic and from the wound must be eliminated; in diabetes this extra load on the process of elimination must be aided by large quantities of water. The diet must be regulated for the diabetes and not for the operation. These patients must not be kept at absolute rest. Coma may become an indication for immediate operation, especially in carbuncles and gangrene.

Diabetes mellitus is a lesion in which operative intervention is more dangerous than the diabetes. The infiltration method of local anesthesia of Schleich is contra-indicated in diabetes, because it lowers the resistance of the tissues to infection. The general anesthesia should be as short as possible, and the quantity of the anesthetic used as small as possible. Diabetes is not a contra-indication for operation on operable malignant tumors, especially if they can be performed aseptically. The worst results are in carcinoma of the rectum, because when the sacral method is chosen asepsis is impossible, and there is a large open wound. Operations upon the stomach and intestines are more favorable because asepsis is possible, but these patients must not be starved.

Furuncles, if treated at all, should be excised; carbuncles should be excised at once. This is very good advice, from my experience, and frequently neglected. Furuncles should first be treated by fixation in collodion; many will heal by this method. Carbuncles should never be temporized with. All cases of suppuration should receive rather more radical treatment. In the so-called diabetic gangrene, which is, of course, due to the associated arteriosclerosis, the indications for amputation and the selection of the point of amputation are about the same as in gangrene without diabetes, except one should not risk delay, if the gangrenous part is infected, for the purpose of, if possible, performing a lower amputation. It is more important in the diabetic patient to amputate at a point where asepsis can be more perfectly maintained and where the blood supply is better.

This paper agrees with my own experience. The only patient with diabetes whom I remember at the present time to have lost, was one in which, I am of the opinion, starvation was the cause of the coma. This patient had had symptoms of diabetes, off and on, for years. According to his physician the sugar had disappeared from the urine, but when I saw him on the fourth day of his disease there was sugar in the urine, but no polyuria. The patient had been treated for typhoid fever and had been suddenly placed upon a very restricted diet and not much water. As there was a left-sided abdominal abscess, with beginning general peritonitis, there was no time for treatment except operation. It was necessary to drain the abscess, and, although we gave the patient large quantities of water with alkali, food was restricted. The patient developed coma on the fourth day and died on the seventh.

SURGERY OF THE MUSCLES.

The various lesions of muscles are of great interest, and, from a practical standpoint, in the differential diagnosis between inflammatory and neoplastic tumors should receive greater attention in the text-books. In *PROGRESSIVE MEDICINE* for December, 1902, 1903, and 1905 the entire subject was fully discussed. Since then the accumulated literature makes further comment necessary.

Arterial Supply of Muscles and Tendons. Wollenberg¹ has studied the arterial supply of muscles and tendons, similar to that beautiful work of Lexer on the vascular supply of bone, and employed the method of Opitz and Hildebrand, in which the arteries are injected with mercury and the arterial tree portrayed on the *x*-ray plate. Wollenberg confines his studies to the large muscles of the lower extremities only. As far as its relation to lesions of muscles and to the operative treatment is concerned, it does not compare with Lexer's work on the bone. His practical conclusions are scanty. In regard to the tendon he has demonstrated that the chief blood supply comes from the peritoneum, and in all tendoplasty this should be preserved as much as possible.

In plastic operations upon muscle a correct knowledge of its circulation should theoretically be of practical importance, and I have examined carefully his illustration of the quadriceps femoris, upon which extensive plastic operations may be necessary for lengthening an old fracture of the patella. The anastomosis of the vessels in the muscle is so extensive that, for practical purposes, one can almost disregard the circulation. This work, however, opens up a new field and should be further carried on.

Physiology of Muscle. I hope next year to devote more attention to this subject. The literature is somewhat scanty, and I am not prepared

¹ *Zeitschr. f. Orth., Chir.* 1905, xiv, 312.

at the present time to present it in a practical way. Physiologists have been particularly interested in the cause of muscle fatigue. This and the various forms of muscle pain (myalgia) are of great interest to the general practitioner.

Injury to Muscles. In a contusion of a muscle one must bear in mind not only the immediate results—rupture or hematoma—but the later results. After a muscle contusion, various forms of myositis, chiefly the myositis ossificans, may take place.

After contusion, an intermuscular sarcoma is by no means infrequent. It is important, therefore, for the practitioner to carefully observe his cases of apparently simple muscle contusion. If the primary swelling does not disappear rapidly it is not always a hematoma, but may be a myositis or a sarcoma. A swelling after complete disappearance of the primary is by no means always sarcoma; it may be chronic myositis ossificans. These points will be again emphasized under myositis and tumor.

Psoas Hematoma. Lesions in the region of the ileopsoas muscle are of interest in the differential diagnosis in the domain of surgery of the extremity, because, before the appearance of the tumor above Poupart's ligament the contraction of the muscle produces flexion, adduction, and inward rotation at the hip, and may simulate some lesion in the hip-joint. The first and only case of infected psoas hematoma which I have seen was diagnosticated and treated for some time as an arthritis of the hip-joint. Moses¹ has collected seventeen examples of psoas hematoma from the literature, all of traumatic origin, one of them in a hemophilic, and reports three observations from Garre's clinic in which the psoas hematomas were observed in patients with the history and signs of hemophilia. The hemophilic hematomas are distinguished from traumatic by the recurrence of the tumor, but now and then in the pure traumatic cases, if the patients are allowed to walk too soon, a recurrence may also take place.

The lesion, therefore, is rare after traumatism and very unusual in hemophilia. The clinical picture does not differ from that in any other lesion of the psoas muscle. The flexion at the hip is characteristic, yet careful examination will exclude a lesion of the joint. The palpable tumor at once fixes the source of the restricted motion at the hip, but one cannot always be sure that it is a hematoma, even with the history of traumatism on one hand, or evidence of a hemophilia on the other. The temperature which may be present in the hematoma, due to the blood ferment, may suggest a tuberculous or pyogenic abscess, and also in sarcoma there may be fever. A reaction to tuberculin should exclude the hematoma in favor of tuberculosis. A leukocytosis, with a differential count in which the polymorphonuclear leukocytes are increased

¹ Beiträge z. klin. Chir., 1905, xlvii, 592.

and the eosinophiles decreased, would be a positive indication of an infected hematoma. Now and then the pulsation of the artery over the hematoma has been misinterpreted as a sign of aneurysm.

The differential diagnosis is important. In hematoma, especially associated with hemophilia, operation, even diagnostic aspiration, is contraindicated, and the best results are obtained from rest and extension of the limb. As a sarcoma in this region would be practically inoperable, no harm could be done by non-interference. The indications for operation are: in non-hemophilics the increasing size of the blood tumor, with signs of anemia; this is very unusual. When there is fever and the blood count indicates infection, the tumor must be explored for drainage. The hematoma, even in hemophilics, may develop a connective-tissue wall and remain clinically as a blood cyst. In Virchow's first case, discovered at autopsy, the tumor had been present three and one-half years in a male, aged twenty-three years.

Blood and lymph cysts in the thigh and ileopsoas areas I have previously discussed.¹ The differential diagnosis of tumors of the psoas and iliac muscle was presented in *PROGRESSIVE MEDICINE* in December, 1903, p. 185, based upon the contributions of Jacobsthal and Göbell. Since then I have found no other references. Now and then a chronic appendicular abscess may be mistaken for a hematoma or sarcoma. There is a recent article on this subject, but I cannot put my hand on the reference. We have a record of a similar case in the Johns Hopkins Hospital surgical department. The wall of the appendicular abscess may be so thick, the lining edematous granulation tissue so abundant, and the pus so inspissated, that at first sight it looks like a broken-down sarcoma. A microscopic study of the wall, of course, would settle the diagnosis.

Rupture and Hernia of Muscle. Binnie² gives a very good description of diagnosis and treatment of these injuries. The more interesting groups of muscles which may be the seat of rupture are the biceps of the arm, the adductors of the thigh, and the quadriceps femoris.

Döbbelin³ describes two cases, one bilateral, both in soldiers; it is the condition called the "rider's thigh."

Quenu and Duval⁴ confine their contribution to the tendon of the quadriceps femoris. Here a differential diagnosis from fracture of the patella can and must be made. Wiesmann,⁵ in discussing ruptures of the biceps, reports his observation, which is of greater interest because it was bilateral and affected the tendon only. In the monograph of Loos⁶ one will find the literature to date embracing a study of some 66 cases. In 37 the muscle was the seat of rupture, in 19 the tendon, and in only

¹ *PROGRESSIVE MEDICINE*, December, 1905, pp. 249 and 257.

² Keen's Surgery, 1907, ii, 444.

³ *Centralbl. f. Chir.*, 1907, xxxiv, 762.

⁴ *Ibid.*, 1905, xxxii, 893.

⁵ *Beiträge z. klin. Chir.*, 1906, xlix, 161.

⁶ *Ibid.*, 1900, xxix, 410.

3 was the seat of tendinous rupture just above its attachment to the radius.

Good results should always be obtained in rupture of the muscle by open incision and suture, but experience has demonstrated that in many cases healing has been accomplished by rest, fixation, and massage. The indication for operation is governed more by the size of the defect and the complete absence of function. When the muscle or tendon is completely ruptured, operation is indicated. In the majority of partial ruptures conservative measures will accomplish good results.

Muscle Paralysis. Now and then the function of a single muscle is destroyed by an injury to its nerves. The points in diagnosis and treatment are brought out in an interesting paper by Samter,¹ in which he describes a case of traumatic paralysis of the serratus muscle. Apparently it was due to a dislocation of the scapula, at which time the thoracic longus nerve was caught between the rib and coracoid process. In view of the position of the nerve injury, it was considered best to do a muscle plastic operation. The sternocostal portion of the pectoralis major was separated from its attachment to the humerus and sutured to the scapula corresponding to the attachment of the serratus magnus. In twelve days function was restored by the substitution of the pectoralis major for the paralyzed serratus. Muscle transplantation, then, is indicated when it is impossible to restore the nerve supply of the affected muscle and when the anatomical condition will allow this substitution.

Ischemic Myositis with Contractions. There is no more pitiful condition than this after an injury, usually a fracture, in healthy, strong children. It is most commonly observed in the forearm with fracture of the forearm bone, or the humerus at the elbow. In the fully developed deformity it is known as Volkmann's contraction. There is a general impression, especially in this country, that the myositis due to the anemia is brought about by tight bandaging. Undoubtedly such cases do occur, but the probabilities are that more are due to injury of the bloodvessel at the time of the trauma. In adults a contusion of an artery, with some subsequent thrombosis, is apt to lead to gangrene,² but in children the tissues have greater vitality, and collateral circulation is more quickly established; gangrene is rare.

For the fully developed ischemic myositis with contraction the results of treatment are not satisfactory, and practically all literature deals only with this stage of the disease. Before discussing this part I would like to emphasize again some points frequently referred to in this journal when discussing fractures. After an injury of an extremity, with or without fracture or dislocation, there should always be an examination for the peripheral pulse; its absence indicates an injury to the artery,

¹ *Centralbl. f. Chir.*, 1907, supplement, xxxiv, 99.

² *PROGRESSIVE MEDICINE*, December, 1899, p. 187.

and until circulation is reestablished no treatment should be employed for the injury which in itself will interfere with circulation. In some cases it may be necessary to cut down upon the artery and restore the circulation by vessel suture. In all injuries to the extremities, especially fractures, the first dressing should never interfere with circulation. In the subsequent treatment good circulation should be maintained by frequent change of dressing, massage, and passive motion.

In my own experience, in all six cases, the primary dressing placed on the arm within a few hours after the accident, was, as far as I could make out, a firm one, usually plaster and had not been changed for from one to three weeks. Preventive treatment will at least allow the physician responsible for the injury to emphatically state that there had been nothing in the treatment of the fracture which could have brought on ischemia and the subsequent myositis, and, therefore, there must have been some injury of the artery. As a matter of fact, cases with such a history I have never seen nor read of. I am of the opinion that an injury of the artery which does not lead to gangrene would be associated with collateral circulation of sufficient degree to prevent ischemic myositis, if the injury had been properly treated.

For *Volkmann's contraction* numerous methods have been advised. Robert Jones,¹ of Liverpool, relies upon purely mechanical and manipulative routine. He is unwilling to enter into the controversy of the etiological relationship between tight bandaging and the myositis, further than to state that the condition, in his opinion, may arise from pressure within the arm. These cases are usually reported by surgeons who did not see the case in the original recent state, and, as Jones remarks, it is usually difficult to obtain a correct history. Of the 24 cases observed in the late stage by Jones, 19 were associated with fracture; in 12 the fracture was of both radius and ulna; in only 1 case was the fracture in the lower third; in 6 the fracture was at the elbow-joint; in 1, of the radius only, in the upper third. In 6 cases there was no fracture; in 2 of these there had been a crush of the soft parts; 1 was secondary to an elastic tourniquet; another was secondary to traumatic myositis ossificans. All of his patients were children under fourteen years of age. The deformity (Fig. 6) is flexion at the wrist, slight hyperextension at the metacarpophalangeal range, and contraction of the fingers. When the nerves are secondarily involved the prognosis is practically hopeless.

Jones' method is as follows: "I cut out of zinc or sheet-iron five splints which will fit the patient's fingers when extended. An assistant is asked to fully flex the wrist and to hold it steadily and forcibly in that position. It will then be noted that by this maneuver the fingers are relaxed, and each one must be separately splinted. The wrist is then

¹ American Journal of Orthopedic Surgery, 1908, v, 377.

released and the patient is directed to systematically attempt to extend the now very contracted metacarpophalangeal range. After a few days this can usually be done sufficiently to admit a splint to be applied from the finger tips to the wrist-joint, the wrist being fully flexed to admit of this. The fingers are, therefore, bound in five splints, and over these the hand is fixed in a splint which reaches to the wrist. For several days the hand is exercised in the direction of extension, and a splint applied over the other splints extending from finger tips to elbow, and is at intervals altered so that by degrees the wrist is fully extended. For some weeks this position is maintained until all contractile elasticity is lost. The splints are then removed and the hand bandaged.

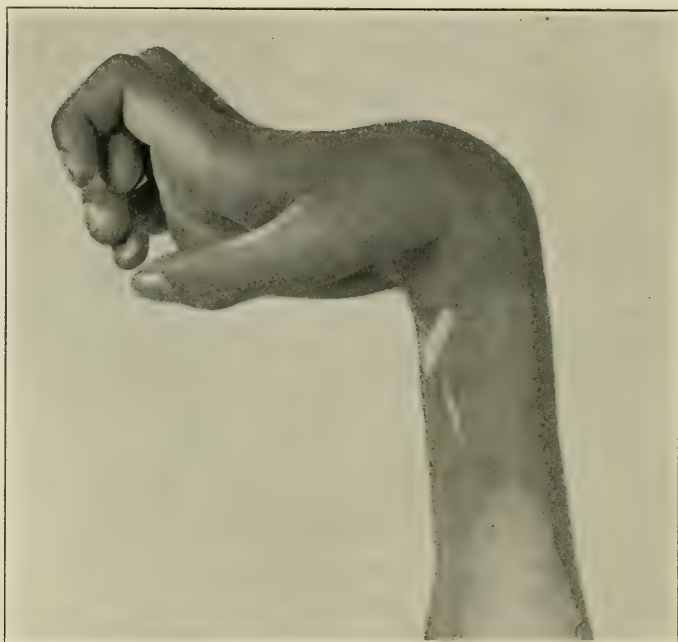


FIG. 6.—Ischemic myositis with contracture after fracture of the forearm.

Jones claims that his results are better than from the operative treatment.

Ferguson¹ reports two cases subjected to operation, with good results. In the first all muscles and tendons of the forearm were matted together by new fibrous tissue. Each muscle and tendon was separated, and the ulnar and median nerves were disengaged and stretched. The flexor tendons were lengthened by a plastic operation; the wound cavity was filled with sterile olive oil and closed. In the second operation the ulnar and median nerves were exposed above the

¹ *Annals of Surgery*, 1906, xliii, 598.

elbow near the seat of the fracture of the humerus, but it was found that they had not been damaged. The musculospiral nerve, however, appeared thickened, but there was no evidence of pressure upon it. Upon the muscles of the forearm an operation about similar to that in the first case was done. In this case the nerves were distinctly involved in the scar tissue, and after their exposure appeared atrophied.

Hildebrand¹ is of the opinion that the most important thing to do is to isolate the nerves from the surrounding rigid muscles and transplant them into the subcutaneous fascia; the muscle defect is then closed. According to him the nerve changes may be primary. Of 4 cases subjected to operation, 1 is cured, 2 are improved, and 1 is recent. Bardenheuer² is of the opinion that the changes of the nerves are secondary. He calls attention to the fact, which I have previously mentioned, that ischemic myositis is more common in children, because in them the circulation after an injury to the main vessel is better maintained by collaterals than in the adult. In reporting ten carefully described cases he is of the opinion that operation with separation of the inflamed muscle should be done. Kleinschmidt,³ in his case, shortened the radius and ulna by resection and succeeded in improving function.

Myositis Ossificans. The literature which has accumulated since 1905 is large. There are more contributions to this interesting lesion of the muscles than to all others combined. However, I do not find in this recent literature much more than additional cases. All the other more important points I⁴ have brought out before. The prevailing opinion of the recent observers confirms the view that osteoid tissue can develop from connective tissue, and it is not necessary to suppose that it is only due to periosteum misplaced by trauma.

Myositis ossificans in some respects resembles ostitis fibrosa. In both there are two types: one involving the entire muscle or osseous system, and the second localized in a single bone or muscle. The myositis ossificans progressiva, or calcinosis multiplex progressiva interstitialis ossificans, is the name given to the general muscle disease, which I first mentioned in 1902.⁵ Since then there is another interesting contribution by Krause and Trappe.⁶ This is a rare disease, most frequent in males and children, and the early diagnosis is difficult. The process is an inflammatory one; it begins in the connective tissue, and the muscle is only secondarily involved. It may stop in the fibrous stage, but, as a rule, there is always some calcification, and in the majority of

¹ Centralbl. f. Chir., 1907, xxxiv, 490.

² Ibid., 1906, xxxiii, 585.

³ Ibid., 1907, xxxiv, 81.

⁴ PROGRESSIVE MEDICINE, December, 1902, pp. 166 and 172; December, 1903, p. 182; December, 1905, p. 246.

⁵ Ibid., December, 1902, p. 166.

⁶ Centralbl. f. Chir., 1908, xxxv, 42.

cases later in the disease definite ossification takes place. The new bone is apparently a product of the connective tissue.

No etiological factor has been demonstrated; syphilis has been considered. We are quite familiar with the ossification of syphilitic periostitis, but this is no argument that myositis in syphilis should be associated with bone formation.

The localized myositis ossificans is always of traumatic origin. In some cases the trauma is intermittent and continuous. This group must be separated from the larger one, in which the ossifying myositis follows a single trauma.

All the important points in the etiology, clinical picture, pathology, and treatment of myositis ossificans traumatica are again brought together in a large contribution by Strauss,¹ who collects 127 cases and gives the entire literature, except some American and English references. This larger collection of cases confirms the statements previously made in PROGRESSIVE MEDICINE from a smaller number of observations. The majority of cases are in the muscles of the thigh and in the arm. The biceps of the arm with 64 cases predominates; the quadriceps with 43 comes next, and there are 13 in the adductor muscles. Up to the time of Strauss' article (1905) the isolated cases were: in the masseter, 2; gluteal muscle, 2; temporal muscle, 1; and the ball of the thumb, 1. Since then Rubesch² has observed ossification in the scar after an operation for an epigastric hernia. The patient was a male, aged forty-three years, and the wound healed *per primam*. As far as I know this is the first case and the best evidence of the possibility of bone formation from connective tissue. Strauss,³ in his second communication, reports the first occurrence of ossification in the subclavian muscle, and illustrates it with an *x*-ray. The bone formation was secondary to an indirect trauma—a dislocation of the acromial process of the clavicle. In view of the intimate connection of the subclavian muscle and the periosteum of the rib and clavicle, the possibility of periosteal origin of the bone formation cannot be excluded. In this case it disappeared spontaneously, and this case can be used as further evidence of the success of conservative treatment. In the two years between Strauss' communications, thirty-two cases have appeared in the literature, bringing the number up to 159.

Machol⁴ calls attention for the first time to the common occurrence of myositis ossificans in the capsule and muscles about the elbow-joint after a posterior dislocation. It is rather remarkable that it has never been found in old unreduced dislocations, only in those which have been reduced in the recent state. Except where the bone formation is extensive, the ossification will be overlooked unless the patients are

¹ Archiv f. klin. Chir., 1905, lxxv, 111. ² Centralbl. f. Chir., 1908, xxxv, 341.

³ Deut. Zeitschr. f. Chir., 1907, lxxxix, 630.

⁴ Beiträge z. klin. Chir., 1908, lvi, 774.

watched for a number of months and studied with the *x*-ray. On account of this possibility, a prognosis after reduced posterior dislocation of the elbow should be guarded. The bone formation varies in extent, and an operation should never be performed until at least one year has passed, because the trauma of the operation may excite new bone formation, and because when left alone the bone is usually absorbed. Interference is only indicated when the nerves are involved, and here one must operate earlier, but for impaired function one should wait at least a year.

This finding of Machol is new, and should be borne in mind. I have not seen many recent dislocations of the elbow, but those which I have observed and reduced have not, to my knowledge, had sufficient ossification about the joint to impair function. The possibility of a periosteal origin of the bone in this group of cases is great, because in a posterior dislocation of the elbow slight fracture of the bone, or tear of the periosteum, must occur in a large number of cases.

Frangenheim¹ reports an example of ossification in the brachial muscle after a dislocation of the elbow. The bone formation was observed a few weeks after the injury.

I find that before Rubesch,² Röpke³ had observed two examples of ossification in scars after laparotomy; in one there was the usual central cyst.

The contributions of Graf⁴ and Vollrath⁵ are of interest, because they demonstrate that even at so late a date as 1907 two observers, studying their own cases, come to different conclusions. Vollrath, who excised his bone tumor fifteen days after the trauma, concludes that it is of periosteal origin, and questions the possibility of true connective-tissue origin, while Graf agrees with the view now generally accepted, that in myositis ossificans traumatica the bone formation may be of connective-tissue origin, and there are a sufficient number of cases in the literature to prove this.

As Röpke, in his excellent discussion, points out, bone formation is by no means unique in tissues far removed from bone; the thyroid tumors, breast tumors, calcified areas in lymphatic glands, in the lung, and so forth, and he collects the observations in the literature which favor the now-accepted view that when the necrotic tissue of an inflammatory focus is not absorbed it is usually calcified, and this deposit of calcium favors the production of bone.

From a diagnostic standpoint, with rare exceptions, the *x*-rays will differentiate the tumor of the benign muscle inflammation from a sarcoma. If there is any doubt exploration should be done. In a recent observation of Dr. Halsted in his own clinic, which he will publish

¹ Centralbl. f. Chir., 1908, xxxv, 648.

² Loc. cit.

³ Archiv f. klin. Chir., 1907, lxxxii, 81.

⁴ Centralbl. f. Chir., 1907, xxxiv, 178.

⁵ Ibid., p. 178.

later, the *x*-rays did not show any bone shadow in the tumor situated in the lumbar muscles near the vertebræ. For this reason it was explored, and the usual blood cyst with young osteoid tissue in the wall was found. Perhaps, on account of the thickness of the body and the small quantity and youth of the bone tissue, it did not appear on the *x*-rays.

As to treatment, the consensus of opinion favors delay unless there is some definite indication, doubtful diagnosis, pressure pain, and so forth. There have been numerous successful cases in which the bony tumor could be completely excised.

When the operation has been performed in the early stage, before the tumor had ceased to grow, recurrence is the rule.

Cysticercus Cellulosæ in Muscle. As this parasite may produce single or multiple subcutaneous tumors, it is important for surgeons and practitioners to bear it in mind in differential diagnosis, and for this reason the excellent paper of Danielson,¹ from von Bruns' clinic in Tübingen, who for the first time collects all the published cases and presents a systematic discussion, justifies a review. Nothing of a similar character can be found, to my knowledge, in English. The contribution is based upon two observations of single tumors in von Bruns' clinic, and thirty-three cases from the literature; eighty-two examples of the multiple form—all from the literature.

Cysticercus cellulosæ is a disease which, according to Orth and Hirschberg, dies out; that is, the parasite disappears. Clinically it presents itself in two forms, as a multiple tumor, or a single swelling. The exact distribution of the multiple tumors can be based upon autopsies only. More frequently the parasite is found both in muscle and internal organs. One, of course, in the multiple disease can be certain of the muscle tumors only, unless there are cerebral or eye symptoms suggesting their presence elsewhere. Their most common occurrence is in the pectoral muscle, then the upper extremity, the body, and, last, the lower extremity. There are small, subcutaneous nodules, painless and freely movable. When calcified they can be made out by the *x*-rays (Stieda). Although not mentioned by Danielsen, the blood count will show a great increase in the eosinophiles, especially when there is some fever and general muscle pain and tenderness. The prognosis is good, except when one of the parasites is situated in a vital organ. The best method to establish the diagnosis is to excise one of the nodules. In the single tumor a correct diagnosis has never been made until after operation when the parasite was demonstrated. If not infected, they must be differentiated from the various benign and malignant tumors. Clinically they will resemble chiefly the benign, and at the exploratory incision there will be no difficulty, from the inflammatory connective-tissue wall and the contents of the cavity, to differentiate it from a tumor which

¹ Beiträge z. klin. Chir., 1904, xliv, 238.

would require a larger operation, but complete excision should always be done. When infected they may resemble a malignant tumor. This is due to the fact that the infection is subacute, and the slow involvement of the skin, especially when the nodule is situated in the pectoral muscle, might be mistaken for a cancer. In one of v. Bruns' cases a diagnosis of cancer of the breast was made.

In Dr. Osler's clinic I have had an opportunity to see a few examples of the multiple lesion, and have excised single nodules for diagnosis. Some years ago, with Dr. Fisher, at the Union Protestant Hospital, I saw a boy suffering with fever and, what he called, abdominal pain, but in addition to multiple areas of tenderness in the abdominal wall there were other tender areas on the pectoral muscles, arms, and thighs, and a leukocytosis of 17,000 showed increase chiefly of the eosinophiles. The correct diagnosis was made, and a nodule in one of the abdominal muscles excised, confirming the diagnosis. On two occasions I have found the parasite in the pectoral muscle removed at a breast operation, but I have never, to my knowledge, encountered the single tumor. Since the article just reviewed the subject has been given full attention in Nothnagel's *Special Pathology and Therapy*, 1904, vol. ii.

Primary Tuberculous Myositis. The principal points in the rare occurrence, diagnosis, and treatment of single tuberculous foci in muscle, I have previously discussed.¹ Since then a very complete article has appeared by Frida Kaiser,² who apparently has collected all the published cases with the literature. However, as Dr. Mitchell is to present this subject before the International Congress of Tuberculosis, I shall postpone further discussion until his article is published. The more important points, however, will be found in my previous discussion.

Primary Hemangioma of Muscle. John S. Davis,³ in reporting some cases under his own observation and those from the clinic of Halsted, of the Johns Hopkins Hospital, tabulates 153 cases collected from the literature, and gives a very complete bibliography of this subject. In *PROGRESSIVE MEDICINE* for December, 1903, p. 184, I first introduced this interesting and perhaps most common muscular lesion, and later⁴ presented the subject with the literature more in detail.

The contribution of Davis may be looked upon as the most complete which has appeared in English literature.

Primary hemangioma of muscle ranks with myositis ossificans traumatica as the most frequent lesion of striated muscular tissue. Apparently in many cases it is of congenital origin, although it is quite possible that trauma may be the direct etiological factor. The tumors are

¹ *PROGRESSIVE MEDICINE*, December, 1903, p. 179.

² *Archiv f. klin. Chir.*, 1905, lxxvii, 1033.

³ *Johns Hopkins Hospital Bulletin*, March, 1908, xix, 74.

⁴ *PROGRESSIVE MEDICINE*, December, 1905, p. 242

most common in children or young adults. It is rather interesting to note that no examples have been observed in the negro race. The characteristic symptoms are compressibility and change in size. These symptoms are not always noted, but in the four cases which I have observed they have always been present. The swelling, as a rule, is of slow growth, and pain of an intermittent character is an almost constant symptom. Pain may be referred to the lower portion of the extremity, and now and then has influenced the physician to look upon the hand or foot as the seat of the disease and not recognize the angioma higher up. In a few cases the patients have been treated for flat foot, on account of the pain referred to the foot and slight equinus due to the contraction of the muscles in the calf, the seat of the angioma. Phleboliths, now and then, can be palpated, and these are suggestive. A varicose condition of the superficial veins of the skin has been present in a certain number of cases over the intermuscular angioma. Liston and Matsuoka observed pulsation in their cases, and a venous hum has occasionally been recorded on auscultation. The tumor is rarely circumscribed, but now and then this has been observed, and, on account of the spherical shape, looked upon as a cyst. As a rule, it is lobulated and of doughy consistency. In older cases in which there is considerable connective-tissue formation one will find on palpation hard and soft areas. When present on the extremity, elevation of the limb reduces the size of the tumor; lowering has the reverse effect. The application of a rubber bandage above will increase the size and tenseness of the tumor. Up to the present time there have been no good *x-ray* studies, but I am inclined to think that in the future they may be of some assistance.

In the differential diagnosis the long duration of the swelling will practically exclude sarcoma, but when the cases are observed shortly after their first appearance and the symptoms of compressibility and change in size cannot be made out, sarcoma cannot be excluded. Among the benign lesions, lipoma and tuberculosis of the tendon sheaths resemble more closely intermuscular angioma than any other lesion. As operation is indicated the nature of the trouble will at once be revealed at the exploratory incision. The angioma presents a spongy, vascular tissue. In the older cases there is considerable fibrous tissue and fat mixed with the spongy, vascular angioma and muscle tissue.

The other lesions mentioned by Davis in the differential diagnosis are the different forms of chronic myositis, syphilis and tuberculosis, myositis ossificans, fibroma and hernia of the muscle, hematoma, hydatid and dermoid cysts, and metastatic carcinoma. Another one to be thought of is the cysticercus cellulosa. In regard to treatment, excision, of course, gives the best results. This radical procedure, however, should never be done at the expense of functioning muscle or with the production of mutilation. When the angioma cannot be

completely excised for this reason, the Paquelin cautery or liquid air should be employed to destroy the blood spaces by the inflammatory reaction which is set up by these applications.

SURGERY OF THE JOINTS.

The most important contribution to the surgery of joints is that by Prof. Erich Lexer,¹ of Königsberg. He has successfully resected ankylosed joints and substituted a new joint from the limb of a recent amputation. In his paper he writes that bony ankylosis can be removed by operation only. To attempt to get motion by interposition of soft parts of all kinds, or the interposition of foreign substances, has been tried with but slight success. Transplantation of cartilage has been successful, but has but a limited field.

Lexer's first case was an ankylosis of the elbow of gonorrheal origin. As the right knee was also ankylosed, Lexer took the patellar surface of the femur, bone, and cartilage, divided it into two equal parts, and placed them in the elbow, cartilage to cartilage. The thin transplanted disks fitted well to the resected ends of bone in the elbow. Healing was perfect, and there was some motion when the patient left the clinic. The final result could not be followed. This case, however, demonstrated the feasibility of the transplantation of bone and cartilage.

In the second case the entire knee-joint from a recent amputation was transplanted into the wound after resection for an ankylosed knee. The patella of the patient was left. In the transplanted knee-joint Lexer took both epiphyses with crucial ligaments, articular and semilunar cartilage. The bone suture was performed with a nail. In this case the interposition of soft parts beneath the patella, which had to be detached from the femur by a chisel, was omitted, and a second operation was necessary to separate the adhesions. This second operation demonstrated complete union of the transplanted joint, and the preservation of the cartilage. A microscopic examination of the union between the transplanted foreign bone and the bone of the patient demonstrated osseous union. In a third case a similar transplantation from a freshly amputated limb to a knee resected for tuberculosis was performed. *X-ray* pictures are shown of both these knee cases five months and nine weeks after operation.

The patients can bear their weight without pain; there is slight lateral motion in one case. Later it will be necessary in these two cases to do muscle transplanting operations to improve function, as active motion is now less than passive. Lexer then attacked the problem of substitution of joints after resection for tumors. The first

¹ Surgery, Gynecology, and Obstetrics, 1908, vi, 601.

observation was a cystic medullary sarcoma of the upper end of the tibia. The articular cartilage of the tibia had to be removed, but the femur was left intact; to fill the defect of the tibia a corresponding bone was removed from an amputated limb. This piece of tibia was covered with its articular cartilage and periosteum. As Lexer had previously found that the bone marrow became necrotic, he curetted the medullary cavity of the transplanted piece and filled it with iodoform. Complete healing took place. Fig. 7 is an *x*-ray picture of the result five months



FIG. 7. (Lexer.)

after the transplantation. The very dark shadow is the iodoform filling. There is good motion as well as definite evidence of callus at the point of union, and the *x*-ray two months after operation showed positive signs of new bone from the transplanted periosteum. Lexer has also substituted the lower portion of the femur of an amputated limb for the upper two-thirds of the humerus removed for sarcoma. One condyle was used to act as the head of the humerus. He has also transplanted a proximal phalanx of the fourth finger, which had been removed for chondroma.

Transplantation of bone, with and without periosteum, has been done successfully for some time. Lexer has simply carried the procedure farther in transplanting cartilage with bone.

I find that Lexer is not the only one to have performed successful

transplantation of the entire joint. Buchmann,¹ in two cases of ankylosis of the elbow, transplanted the first metatarsophalangeal joint of the great toe into the resected wound. The new piece of bone came in contact with the resected humerus and the ulna; the head of the radius and the corresponding portion of the humerus were sufficiently excised not to interfere with joint motion. The metatarsophalangeal joint was selected from the patient because such an excision does not interfere with the function of the foot. The entire joint unopened was transplanted; bone suture was not necessary. Healing was perfect, the motion was better than after the ordinary resection of the elbow, and the arm stronger.

In the details of the technique, the olecranon process of the ulna is resected subperiosteally; then the joint is opened by forced flexion with severing of the ankylosis; the attachment of the brachialis anticus to the coronoid process of the radius is detached with the periosteal elevator, and the articular surface of the humerus sawed away. This is done through a longitudinal posterior incision. A niche is then made in the ulna and humerus, and the transplanted joint fitted. To get proper motion the plantar surface of the joint becomes anterior in the elbow, and the metatarsal end fits in the humerus, and the phalangeal in the ulna. The wound is closed and the arm fixed in plaster in extended position.

Etiology of Joint Diseases. As the recognition and treatment of all forms of arthritis belong almost strictly to surgery of the extremities and orthopedics, I have attempted in these articles to keep fully abreast of the important additions to recent literature. The subject is an unusually large one, and much of it belongs to the domain of the specialist. However, there are many problems with which the general practitioner should be familiar, especially those of etiology and diagnosis. With this education he will be able to select and refer to the specialist those cases which require more expert surgical treatment.

There are far too many single and multiple ankylosed joints in every country. In the United States, in view of the opportunity of a rapid diffusion of knowledge among the profession, and due to the fact that the mass of people are better educated, more intelligent, and seek advice of the physician earlier, we should see each year fewer cases of chronic arthritis with ankylosis and deformity.

Clinical experience and laboratory investigation are emphasizing each year more and more that traumatism and infections are the chief etiological factors of those joint inflammations which lead to ankylosis and deformity. The common occurrence of gonorrheal arthritis is beginning to be recognized by all.

Gout may be looked upon as a form of arthritis in which infection plays no part. In gout, metabolism is chiefly at fault, and the arthritis is due to the irritation of deposits of urate of soda in the connective

¹ *Centralbl. f. Chir.*, 1908, xxxv, 582.

tissue near joints, bursæ, and tendon sheaths. Gout is controlled entirely by dietetic means. The gouty arthritis rarely becomes infected, and it is seldom necessary to intervene surgically. In all other forms of arthritis it is a great question whether faulty metabolism is an etiological factor. Rather the metabolic changes observed in polyarthritis are caused by the same infectious agent as the joint lesion itself.

In the joint lesions of scurvy, purpura, and other allied diseases the hemorrhage in the synovial membrane and in the joint acts as an irritant. Infection, except secondarily, plays no part. It is a very unusual observation to see such a joint go on to destruction and ankylosis. König has described a few cases in hemophilia.

In the arthropathies associated with syringomyelia and tabes dorsalis trauma is the chief factor which leads to the gross joint changes. If these joints are protected early, the pathological changes are arrested.

Intermittent joint hydrops apparently is a symptomatic condition, and these rare cases demand the most careful differential diagnostic study. In my single observation, reported in *PROGRESSIVE MEDICINE*, some years ago, the patient turned up later with typical gumma. So one must conclude that the intermittent hydrops was of luetic origin.

In every case, therefore, of acute or chronic joint inflammation, one must search for trauma or infection. The most important to look for first is infection. If there is a joint effusion, bacteriological studies should be made at once from the aspirated fluid. The negative findings by no means exclude infection, while positive demonstration of organisms at once clinches the diagnosis. In either event one must search for a portal of entrance; the genito-urinary tract for the gonococcus; the tonsils, nasopharynx, the teeth, furuncles, tuberculous and non-tuberculous lesions of the lung. Every patient suffering with acute or chronic joint inflammation should have the tonsils removed, the nasopharynx treated, all carious teeth extracted or filled after disinfection. It seems surprising that for years we have concentrated our attention on the joints (surgeons), or on some changes in metabolism (physicians), and not investigated for the source from which the infections flowed.

Traumatic Arthritis. I can find nothing in recent literature that can be looked upon as especially new. In the previous numbers of *PROGRESSIVE MEDICINE* all the more important facts have been discussed. Certain phases, however, demand repetition. Trauma as an etiological factor in joint inflammation may act in various ways. In some the trauma is such a prominent feature that both physician and surgeon cannot overlook it. In other cases the trauma is so remote in time or so indirect that it escapes notice.

Traumatic arthritis may be divided into two groups: In one there is a single trauma; the harm is accomplished. To this class belong all contusions and sprains. In the second group the trauma is usually slight and continuous. For example, the traumatism to a joint from a

flat foot, or any acquired or congenital deformity which changes the weight-bearing plane of the lower limb, or compels the joint of the upper extremity to work at a disadvantage. After a contusion or a sprain, slight trauma may continue, due to the relaxation of a tendon or capsule, or the presence of a loose piece of cartilage. Many in the profession will not realize the extensive changes that may follow continuous trauma. First, there is joint effusion which leads to distention of the joint capsule and relaxation. The articular surfaces receive the burden differently; at the point of greatest pressure they are worn away, and at the least pressure there is expansion of the spongy bone behind the articular cartilage. In the synovial membrane and at the periosteal cartilage border there may be a newgrowth of cartilage and bone. Such extensive changes are more often seen as the result of continuous trauma in the arthropathies of syringomyelia or tabes, but they can occur with any lesion of the nervous system.

When traumatism to joints are properly treated in the recent state by protection, passive motion, and massage, secondary conditions do not follow. When slight joint effusion, with or without pain, is subjected to careful investigation, one will find at the exploratory arthrotomy relaxation of the capsule or tendon, joint fringes, or loose cartilages which are keeping up the irritation, and which, when removed, relieve the condition. When deformities are corrected, the arthritis of the neighboring joints disappears. Recent literature contains many articles reporting examples, single or in groups, of just such occurrences, and my own experience is increasing with each year. I am convinced that physicians in general practice are not sufficiently keen in their investigations on the relation between trauma and arthritis.

Pyogenic Arthritis. We have not a good term to describe that form of infectious arthritis in which the effusion becomes rapidly purulent and in which there is no difficulty in finding on coverslips and cultures a pyogenic organism. I have discussed this form frequently in *PROGRESSIVE MEDICINE*, and there is practically nothing new in recent literature. It must be distinguished from the larger group of infectious arthritis, because immediate arthrotomy and irrigation of the joint is demanded. Although a few surgeons have practised this for years with splendid results, it is by no means the general method. For this reason many joints go on to ankylosis which could have been saved by early arthrotomy and irrigation.

In view of what has been written about Bier's hyperemia and the vaccine treatment of infection, I fear that delay in arthrotomy and irrigation will be considered justifiable by some in order to make attempts with the more conservative treatment. Certain organisms, when they reach the synovial membrane, produce an inflammation which rapidly replaces the synovial tissue by granulation tissue, and the purulent exudate destroys the cartilage. Unless this inflammatory

reaction, which is always excessive in these cases, is checked in the early days, the granulation tissue, when the inflammation subsides, leaves sufficient scar tissue to impair function. It is true that when one finds the typhoid bacillus, as a rule, aspiration, with or without Bier's hyperemia, is sufficient. Cases are reported of cures with good function in gonorrheal arthritis after Bier's hyperemia, but in these reports there are very few bacteriological studies. Cole,¹ in his splendid chapter on gonorrheal infections, was able to report but one case in which the gonococcus was demonstrated in the effusion, which recovered with good function without arthrotomy and irrigation.

In my own experience I have never, until recently, treated a case of gonorrheal arthritis in which I found the gonococcus in the affection, except by arthrotomy and irrigation. In all cases in which the operation was performed early, function has been restored. During the same period of years I have observed, and been called upon to treat, numerous examples of ankylosis of one or more joints, due to gonorrheal infection which had not been treated by arthrotomy and irrigation. I am quite confident, then, in my advice in regard to arthrotomy and irrigation. In patients with a gonorrheal local infection and joint symptoms the effusion should be aspirated; if it is sterile, arthrotomy is only indicated in those cases of excessive peri-articular exudate described by König. If the organisms are found in coverslips or cultures, operation is indicated at once. That recovery is not possible when the effusion contains the gonococcus, without arthrotomy and irrigation, I am not prepared to say. Cole reports only one case. I have recently observed another. The patient was a woman with gonorrheal vaginitis of two weeks' duration. There had been pain and swelling of the right shoulder one week; there was no peri-articular exudate; on aspiration I found purulent fluid, in the coverslips leukocytes with the gonococcus in and out of the cells, and Dr. Sladen cultivated the gonococcus from the joint effusion. This patient refused further operation, and is apparently getting well without any other treatment to the joint.

If the streptococcus or staphylococcus is found and there is no external wound or infection, one should be suspicious that the arthritis is secondary to an osteomyelitis (Figs. 8 and 9). This is also true when one finds a periosteal pyogenic abscess. In both instances surgeons are very apt to treat the evident, and overlook the concealed, focus in the bone.

In my own experience, following the advice of Halsted, I have irrigated the joint, first with a solution of 1 to 1000 bichloride, and then with salt solution; in early cases the wound is closed; in late cases it is left open; in very severe cases only would I advise drainage, and that only with protective rubber cloth. Stronger antiseptics, like carbolic

¹ Osler's Modern Medicine, 1907, iii, 99.

acid, or packing with gauze, so irritate the already inflamed synovial membrane that an excessive inflammatory reaction will be induced, which, after subsiding, will leave sufficient scar tissue to impair function.

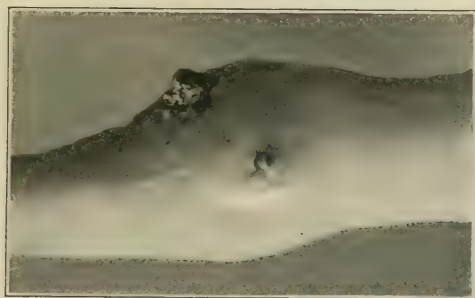


FIG. 8.—Pyogenic osteomyelitis with secondary arthritis, resulting in marked sequestrum formation and involucrum requiring amputation. Photograph of ankylosed knee joint with projecting sequestrum. (Bloodgood.)

Summers¹ advises Harrington's solution as an antiseptic irrigation for suppurative inflammation of the joints, but the case that he tried it in had already reached such a stage of inflammation that ankylosis could only

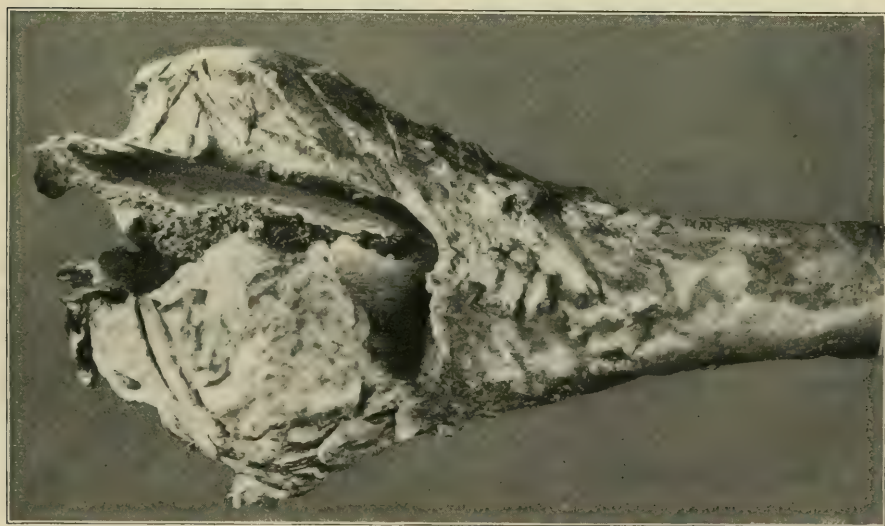


FIG. 9.—Photograph of dried specimen. This result was due to the failure to recognize the primary focus in the bone. (Bloodgood.)

be expected, and Summers, as a matter of fact, used Allen's method, in which the joint is opened widely, disinfected, and packed with iodo-

¹ Surgery, Gynecology, and Obstetrics, 1908, vi, 405.

formized gauze. Such radical treatment is only indicated in severe cases when there is no hope of saving the joint with motion.

PNEUMOCOCCIC ARTHRITIS. In *PROGRESSIVE MEDICINE* for December, 1899, p. 224, in my first discussion on osteomyelitis I presented the literature of pneumococcus infection. Since then the number of cases in the literature has accumulated, but nothing has been added to the subject as to diagnosis and treatment. Herrick, quoted by Musser and Norris,¹ from a very elaborate study of pneumococcus arthritis after pneumonia, concludes that the treatment should be immediate incision and drainage, except when the effusion is still serous; here aspiration may be tried first. Nitch² brings the literature up to 1907, confining his discussion to pneumococcic arthritis in children. McGlannan³ gives an excellent *resume* of pneumococcus infections of bones and joints. The relationship was first recognized by Ullman in 1891.

GNORRHEAL ARTHRITIS. I am interested in presenting the results of hyperemia and the vaccine treatment. The best exposition of hyperemia can be obtained in the contribution of Bätznér,⁴ who reports on forty cases treated in the Berlin clinic since 1904, first under the supervision of von Bergmann, and later of Bier himself. When it is stated that the hyperemic treatment of Bier, which is associated from the onset with passive motion and massage, has given far better results than the previous treatment with immobilization in plaster, anyone familiar with gonorrheal arthritis will not be surprised. Fixation of a gonorrheal joint should never be practised.

In this list of cases there is not a single aspiration for bacteriological study, so we have no evidence that the gonococcus was present in the effusion. Another thing surprising among these forty cases is that but two involving the knee joint are found. From the literature and my own experience the knee is the joint most frequently involved, and the complication of partial or complete ankylosis most common. Nevertheless, the results of treatment in these forty cases are too good for any other deduction, except that Bier's hyperemia should at least play a part in the treatment of every gonorrheal arthritis. That it relieves pain, and thus allows early passive motion and massage is of itself a very important curative element, and, as Bier states, the earlier the hyperemia is induced the better the result.

Among their thirteen cases there is a perfect result and good function in every one; here treatment was begun from two to six days after the onset of the symptoms and continued for from eight days to six weeks; they were all single joints: seven wrists, three elbows, and three shoulders. In six of these it was a simple effusion; in seven there were peri-articular

¹ Osler's *Modern Medicine*, 1907, ii.

² *British Medical Journal*, September 21, 1907.

³ *Maryland Medical Journal*, March, 1906.

⁴ *Deut. Zeitschr. f. Chir.*, 1908, xciii, 46.

exudates—the so-called phlegmonous form of König. This peri-articular exudate, in my experience, is practically always present in the gonorrheal arthritis of the wrist and elbow, and, from a prognostic standpoint, does not mean as severe an infection as when observed in the knee, hip, and shoulder. In twenty-seven cases the treatment was not begun until the tenth to twenty-first day, and here, too, the earlier cases did best. In this group there are twelve wrists, seven elbows, four shoulders, one ankle, and one knee; two multiple cases—knee and wrist, and knee and ankle. The treatment varied from six days to three months. In twelve cases the result was perfect as regards function; in the remaining there was some restriction of function, but not a single case of complete ankylosis. As regards technique, the bandage is practically kept on continuously from twenty to twenty-two hours *per diem*. It is applied over a broad surface over the thigh or arm, after the manner previously discussed in a former number of PROGRESSIVE MEDICINE. The bandage should relieve pain and produce, if possible, a red, warm hyperemia. From the beginning massage and passive motion are used, and, later, in the more severe cases, hot-air baths.

Cole¹ and Meakins give their results in fifteen patients with gonorrheal arthritis treated with vaccines. They state that the results have been encouraging and justify further trial. The best results were obtained in acute cases, but there was some improvement in chronic cases also.

SYPHILITIC ARTHRITIS. The joint lesions of syphilis are frequently overlooked. I² have given this subject but slight attention since 1902, and although the recent contributions present nothing especially new, yet there are certain points which need to be emphasized again, and these are best found in the contribution of Bosse.³ It is rather interesting and by no means yet explained that the syphilitic virus is more apt to show its effect in the periosteum; the gonococcus in the joint, the pyogenic organisms in the bone. Tuberculosis attacks both; perhaps it predominates as a primary focus in bone. But in syphilis there may be a distinct arthritis, with or without gumma formation in the synovial membrane, and with or without bone involvement.

It is very important to remember that a syphilitic periostitis is usually associated with bone formation. When present in the neighborhood of a joint and associated with arthritis, it shows in the *x*-rays an osteo-arthritis, and may be mistaken for chronic arthritis deformans. When it begins in the shaft of the bones there may be a tumor formation, which, from its clinical picture and *x*-ray shadow, might be confused with an ossifying periosteal sarcoma. Bosse describes the arthritis in the early stage of syphilis, which consists chiefly of an effusion. Like all the symptoms of syphilis at this stage, it reacts quickly to therapeutic measures. After healing, joint crepitus may remain. In the later stage

¹ Loc. cit.

² PROGRESSIVE MEDICINE, December, 1902, p. 145.

³ Centralbl. f. Chir., 1908, xxxv, 257.

of syphilis the arthritis may be associated with gumma formation, single or multiple. Now there may be destruction of cartilage, involvement of bone, with both, bone destruction and new formation. Bosse is of the opinion that a histological study of a syphilitic arthritis before the stage of gumma will demonstrate a specific cellular picture. I have read his histological description carefully, and from my own experience, which has been quite large in the pathological study of joint lesions, I cannot agree with him.

I am of the opinion that the best way to diagnosticate a syphilitic arthritis is the therapeutic test in all obscure cases. The osteo-arthritis seen in the x -rays is by no means characteristic of syphilis alone; it is very common in gonorrheal arthritis.

The most important point in the diagnosis of congenital syphilitic lesions of the joints is their frequent occurrence with *keratitis*. It is interesting that an oculist, Förster, in 1876, was the first to call attention to this, and practically all the early literature on this subject was contributed by oculists. Without the keratitis, and with no other evidence of congenital lues, the diagnosis of congenital syphilitic arthritis is a difficult one. Here, again, Bosse says the histological study of the synovial membrane will show a specific picture. I have not had sufficient experience with congenital lesions to criticise this statement, but it does not impress me that further experience will demonstrate its correctness.

ARTHROPATHIES. The joint lesions, intermittent joint hydrops, and the arthritis associated with *tabes dorsalis* and *syringomyelia*, have been very fully discussed in former years.¹ In recent literature there are not very many references to this subject, nor has anything of special importance been added. Barker² gives a very interesting *resume* of the joint affections in nervous diseases. In addition to the three which I have already mentioned he adds a fourth—arthralgia psychoneurotica. In criticism of his remarks on intermittent hydrops in which he says, "A surgeon, if unfamiliar with the disease, may be tempted to suspect an irritable synovial fringe or a loose semilunar cartilage and advise operation," it may be remarked that, as a matter of fact, intermittent hydrops is more often a symptom of a definite pathological lesion in a joint than a neurosis, and fewer mistakes will be made by proper exploratory arthrotomy than in the conservative attitude of the neurologist. I have seen a great many cases of intermittent joint hydrops, and in every instance, at the exploratory arthrotomy, found the cause, except in one, which I have mentioned here before. In this case the disease was looked upon as a neurosis, but later turned out to be syphilitic. I should advise, after all the usual efforts at a differential diagnosis have been made, and after an antisymphilitic treatment, to per-

¹ PROGRESSIVE MEDICINE, December, 1900, p. 187; December, 1902, p. 147; December, 1904, p. 218; December, 1906, p. 263.

² Journal of the American Medical Association, February 2, 1907, xlviii, 384.

form exploratory arthrotomy. One will be surprised at the number of chronic villous arthritides, loose cartilages, syphilitic and chronic gonor-



FIG. 10.—Osteoarthritis, tabetic (Charcot's joint). Patella and synovial membrane of joint, showing erosions (X), new cartilage formation (Y), organization of fibrinous exudate on synovial membrane (A), and soft joint-body formation (B). (Bloodgood.)

reheal arthritides which present themselves with no other symptoms except intermittent joint effusion.

In regard to Charcot's joint I am quite confident that if protection and support are given in the early stages the severe pathological destruction will not take place. In this country the joint lesions of syringomyelia are very unusual (Figs. 10, 11, and 12).

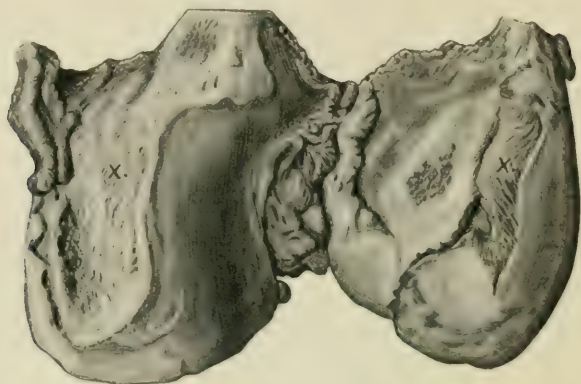


FIG. 11.—Femur showing erosions (X). (Bloodgood.)

Arthralgia psychoneurotica, or the so-called hysterical joint, is a distinct traumatic neurosis. It is very important in this group of cases, before following the purely psychical treatment, that there be no definite lesion from the traumatism. In the majority of these cases there has been a traumatism. When the surgeon recognizes the neurotic tempera-

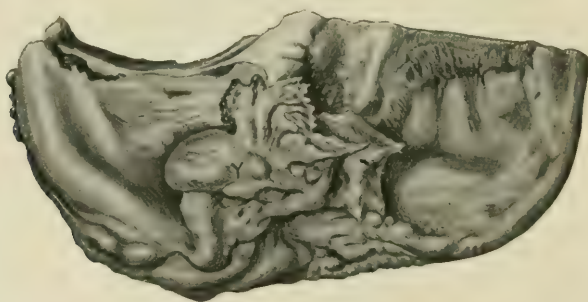


FIG. 12.—Tibia showing erosions (X) and new cartilage formations (Y). (Bloodgood.)

ment of the patient, he must be particularly careful, even though there be definite evidence of trauma, to minimize the importance of the local condition before the patient. Yet it is a mistake not to give such joints some treatment. The definite surgical treatment of the local lesion must go hand-in-hand with the psychical, which at the present day is true in most all surgical cases. A surgeon requires all the art of the

specialist in psychotherapy in almost all of his work. Healy¹ gives an excellent summary on intermittent joint hydrops.

CHRONIC NON-TUBERCULOUS ARTHRITIS. In the great group of non-tuberculous joint lesions in which the ordinary pyogenic organisms can be excluded there is little room for investigation. Each year the view that they are of infectious origin gains ground. We now know that the gonococcus may produce the typical picture—the so-called chronic polyarthritis deformans. It is the present opinion that these subacute and chronic single and multiple arthritides are produced by infectious agents or their toxins which reach the joint in different degrees of virulence, intermittently, from a single source—the follicles of an enlarged tonsil, an infection in connection with the teeth or accessory sinuses of the nose.



FIG. 13.—Chronic tuberculous arthritis of knee-joint. Photograph of excised specimen. Practically no involvement of cartilage; synovial membrane converted into fibrous tissue; very few minute tubercles. Clinically resembles chronic non-tuberculous arthritis. (Original, Bloodgood.)

With each general re-infection the arthritis recurs and new joints become involved. Each new inflammatory reaction in the joint leaves its residue of scar tissue, with a corresponding increase in impairment of function. Due to the pain and enforced rest there is muscle atrophy, tendon-sheath involvement, and general metabolic changes. Different stages have different clinical pictures. From the onset to the end the pathology of the joint tissue presents a variegated and apparently different gross and microscopic histology. However, when carefully studied everything can be explained as a simple inflammatory reaction with its tissues of new formation and its necroses. In some cases the synovial membrane is converted into fibrous tissue, and there is very little change in the bones or joint (Fig. 13). To this group the term atrophic

¹ Surgery, Gynecology, and Obstetrics, 1908, vi, 466.

arthritis has been applied, while in others the ends of the bones and the capsule thicken, and this variety is called hypertrophic. When there is much new-bone formation it is called osteoarthritis. In a definite group, the principal pathological change is villous arthritis. I am quite convinced, from the literature and my own pathological studies, that the gonococcus can produce each and every one of these different pathological pictures. As Adami states, in the inflammatory process, in one instance it may be insufficient, and in the other excessive. In a gonorrheal arthritis, in different individuals and in different joints in the same individual, the inflammatory reaction and its results vary from causes many of which we do not know. It is perfectly possible that other organisms may act in the same way, especially the streptococcus.

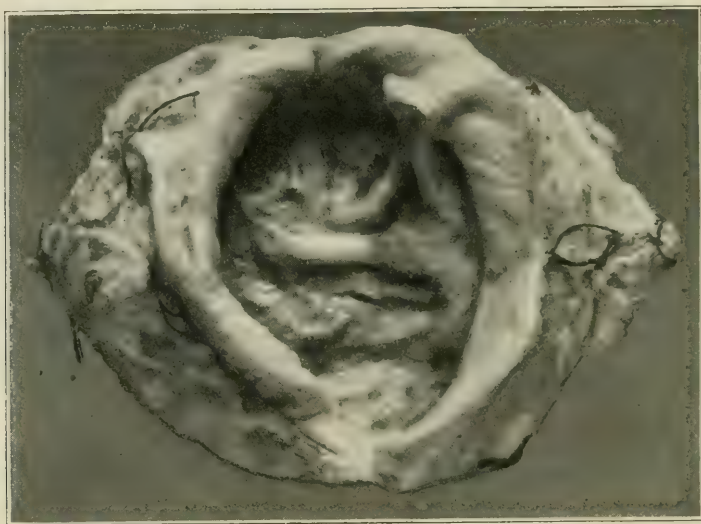


FIG. 14.—Chronic bursitis, prepatellar bursa. Colored woman, aged fifty-five years; intermittent tumor eight years; permanent swelling six months. Photograph of cut open, thick-wall bursal sac. Microscopic picture, chronic inflammation with organization of fibrinous exudate in layers; no tuberculosis. (Original, Bloodgood.)

The important fact, therefore, to remember, and one which I have referred to before, is the search for the source of infection.

Surgery of the Bursæ. The etiological factors and the pathological anatomy of lesions of the bursæ are almost identical with those of the joints. In the ordinary bursa (Figs. 14, 15, 16, 17, 18, and 19) there is no communication of the synovial sac with cartilage, but in the bursæ which develop over exostoses the relation of this synovial sac to the cartilage covering the exostosis is practically like in a joint. For this reason, in the so-called exostosis bursata (Fig. 20) we may have carti-

lage and bone bodies free or attached to the synovial membrane of the bursa. In *PROGRESSIVE MEDICINE* for December, 1903, I have discussed this question, and Plate IV, page 194, is one of the most beautiful colored illustrations in the literature, representing the possible cartilage and bone formation in exostosis bursata.

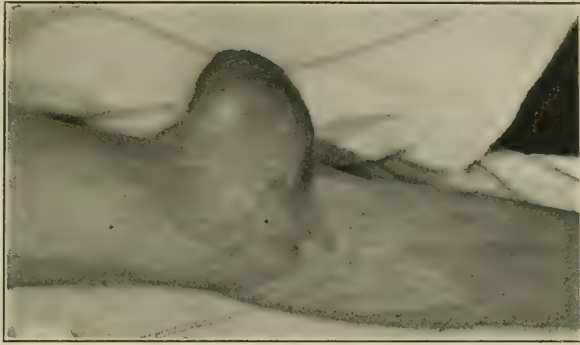


FIG. 15.—Chronic non-tuberculous bursitis; prepatellar bursa. Photograph of knee showing tumor. (Bloodgood.)

SUBDELTOID BURSITIS. Codman¹ was one of the first in this country to call special attention to the clinical picture and pathological anatomy of acute and chronic inflammations of the subdeltoid bursa near the shoulder joint. This condition is frequently incorrectly diagnosed as

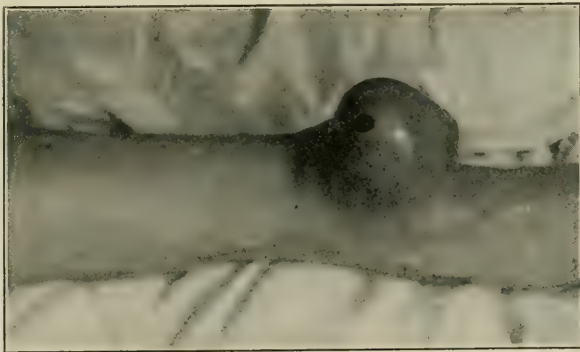


FIG. 16.—Chronic non-tuberculous bursitis; prepatellar bursa. Photograph of knee showing tumor. (Bloodgood.)

arthritis of the shoulder joint, or neuritis of the nerves about the shoulder. The symptoms, however, are all due to the inflammation of the bursa. Codman, in his first paper, recommended forcible breaking up of the

¹ Boston Medical and Surgical Journal, May 31, 1906, cliv, 613.

adhesions, placing the arm in a splint in an elevated position for three or four days—a successful but very uncomfortable treatment. In a second



FIG. 17.—Photograph of excision of bursal cyst under local cocaine anesthesia without opening the knee joint. (Original, Bloodgood.)

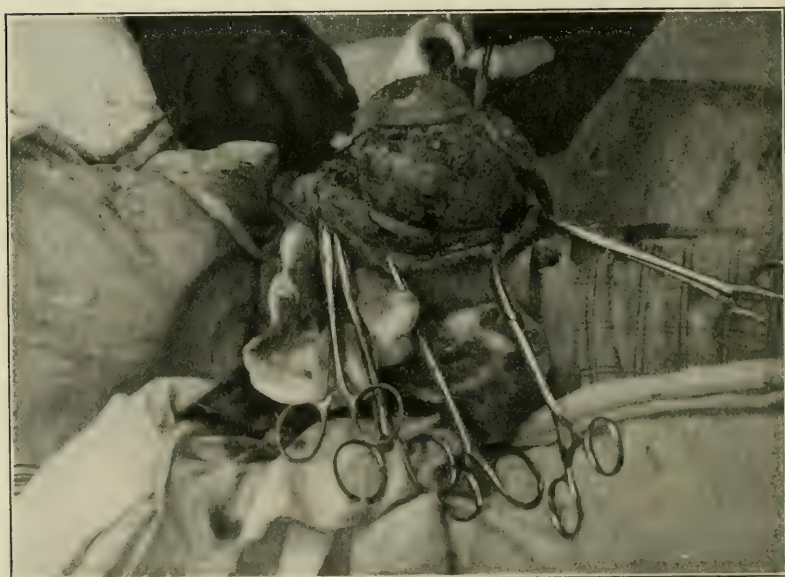


FIG. 18.—Photograph of excision of bursal cyst under local cocaine anesthesia without opening the knee joint. (Original, Bloodgood.)

paper he recommended operative excision of the bursa in a selected group, and in other cases, after breaking up the adhesions under ether, he has given up fixation in the uncomfortable position and uses passive motion and massage. Baer¹ recommends the operative treatment and gives some very interesting illustrations. Fig. 21 shows well the anatomical position of the bursa.



FIG. 19.—Photograph of excision of bursal cyst under local cocaine anesthesia without opening the knee joint. (Original, Bloodgood.)

Stieda,² after studying eight cases clinically and with the *x*-rays, comes to the conclusion that gouty deposits in this bursa are the chief etiological factor in acute and chronic bursitis. Traumatism starts up a bursitis more readily and with more acute symptoms if there are gouty deposits in the fibrous tissue outside of the synovial lining. In one of the cases the *x*-rays showed the gouty (?) deposits in the bursa on both shoulders. The patient had no symptoms on the right side and only recently on the left following a trauma. He claims that the shadow of these gouty deposits may be mistaken for a fracture of the greater tuberosity. When one compares Baer's *x*-rays with Stieda's, the picture which Baer interprets as a fracture of the greater tuberosity cannot be distinguished from Stieda's, which is interpreted as the shadow of the gouty deposits; but in Baer's case, according to his statement, he demonstrated the fracture at the operation, while in Stieda's cases there were

¹ Bulletin of the Johns Hopkins Hospital, June-July, 1907, xviii, 282.

² Archiv f. klin. Chir., 1908, lxxxv, 910.

no operations—therefore, no pathological examinations to prove his point of the presence of a gouty deposit.

Another argument in favor of gout by Stieda is that in some of his cases there were signs of inflammation of other joints; one of these, that of the great toe, but in none of his cases did he demonstrate tophi. I am of the opinion, therefore, that Stieda has not proved his point.

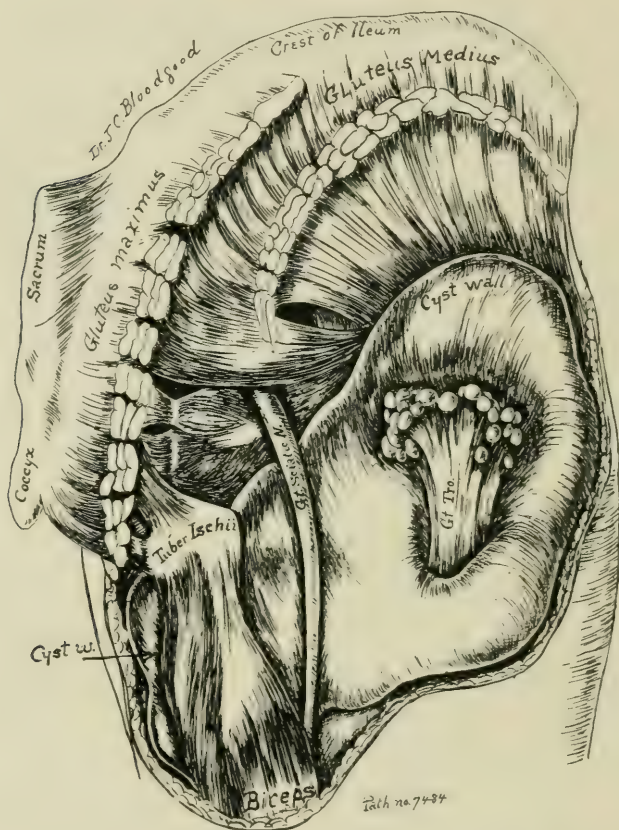


FIG. 20.—Exostosis bursata. Sketch to show the exostosis springing from the greater tuberosity of the femur; cyst wall partially removed. (Bloodgood.)

A bursa may take part in a polyarthritis from any cause, and, as is frequently the case in polyarthritis, all but one focus may recover spontaneously. On account of the anatomical position of the subdeltoid bursa, its relation to the muscles and motions of the shoulder joint, a slight effusion and slight degree of inflammation of the bursa and the surrounding tissues are always associated with symptoms out of proportion to the inflammatory process.

Subdeltoid bursitis, therefore, may be due to a single traumatism or

to direct infection from a neighboring portal of entrance, like an infected finger or glands of the axilla, or it may be part of a general pathological process. In all forms of infectious arthritis traumatism may localize the joint lesion. The same may be true, of course, of the bursa.

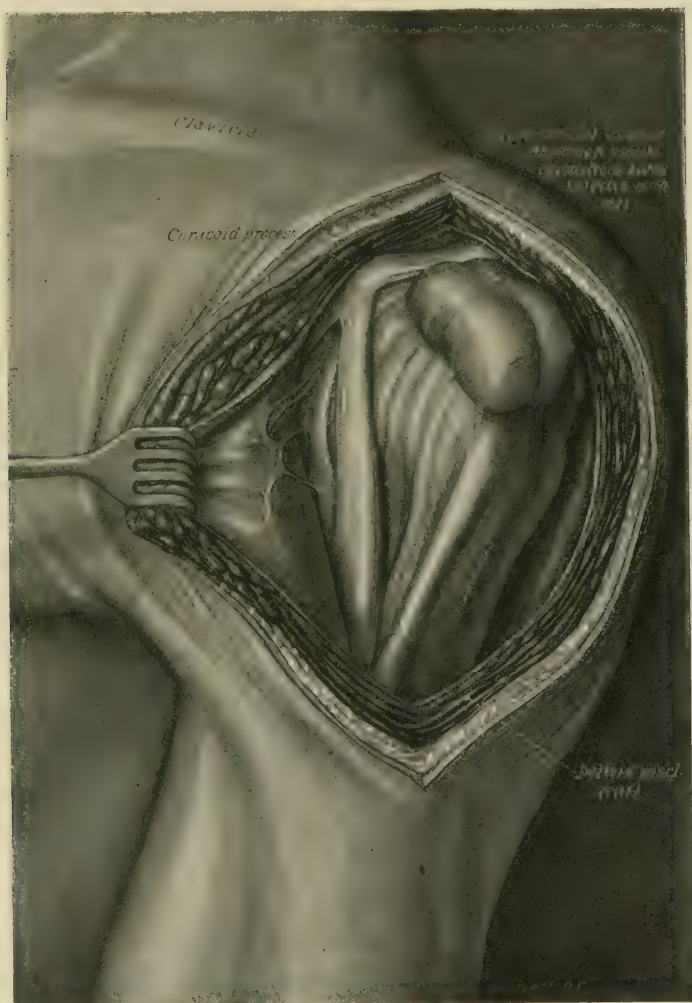


FIG. 21.—Subdeltoid bursitis. (Baer's case.)

In the acute early stage of subdeltoid bursitis the pain is intense; the arm is held rigidly to the side of the body; passive and active motion, especially abduction and attempts at elevation, are excruciatingly painful, but rotation, which would be restricted and painful in a shoulder-joint arthritis, is free in bursitis. With any attempted elevation of the arm the scapula moves. Careful palpation, as a rule, will find a dis-

tended bursa. As the inflammation subsides and the condition becomes chronic, the restriction is less and the pain brought out only on certain motions, chiefly abduction. A diagnosis is not at all difficult. In the early acute stage there should be hot applications, or the Paquelin cautery, massage and gentle passive motion. No fixation dressing should be employed. The massage and passive motion should be more energetic each day, and the patient urged to use the arm. With this proper treatment, I am inclined to think, in the majority of cases, a good result will be obtained. When seen, however, in the later stage the adhesions must be broken up under ether or the bursa excised.

TUBERCULOSIS OF BURSÆ. Wieting¹ has written a very good paper considering chiefly tuberculosis of the bursæ near the pelvis. Wieting, who is one of the surgeons employed by the Turkish Government, calls attention to the fact that tuberculous and non-tuberculous bursitis in the region of the great trochanter or tuber ischii are apparently more common among the Turks, and may be attributed to their custom of sitting on the floor with thighs widely abducted and legs crossed. It is rather interesting to note that the only cases of tuberculosis of these bursæ which I have observed have been in tailors who sit Turk fashion. It is difficult to make a clinical diagnosis in the early stage between tuberculous and non-tuberculous bursitis, except with the tuberculin test. In the non-tuberculous form the palpable tumor has a much denser and thicker wall, while in the tuberculous it is apt to be soft and boggy. Complete excision is the proper treatment in both, especially in the tuberculous, because if left alone perforation takes place with gravitation abscess.

TUMORS OF THE BURSÆ. In *PROGRESSIVE MEDICINE* for December, 1906, p. 251, I discussed the various benign and malignant tumors of the synovial sac of the joints, and the difficulty, clinically and sometimes pathologically, to distinguish between the inflammatory and neoplastic tumors. The lipoma arborescens is now looked upon as a form of villous arthritis, and in some cases the definite angiomas are hard to distinguish from the very vascular villous arthritis. The primary sarcomas are very rare tumors.

Apparently benign and malignant tumors of the bursæ are less frequent than in the joint. Martina,² in reporting his case, gives reference to the last complete study of the literature by Adrian.³ The contribution of Martina is of interest, in that it reports a myxofibrosarcoma of the bursa behind the tendo Achillis; but Adrian's paper, in addition to reporting his own two cases, gives a detailed description of all the cases that he has been able to collect in the literature—seventeen. We have, therefore, up to 1906, but twenty observations of true tumors of the bursa. In view of the impossibility of getting information on this subject, except

¹ Deut. Zeitschr. f. Chir., 1904, lxxiv, 443.

² Ibid., 1906, lxxxiii, 317.

³ Beiträge z. klin. Chir., 1903, xxxviii, 459.

in such original articles, I feel that it is worth while to discuss these cases somewhat in detail.

After reading each case carefully, the first thing that impresses one is the impossibility of making a clinical diagnosis between a benign and malignant newgrowth, and the tumor due to an inflammation of the bursa. For this reason I should advise in all cases of bursitis with tumor formation an exploratory incision into the tumor, to allow a positive diagnosis. Only in this way will the very infrequent sarcoma be recognized, and the surgeon will give himself the opportunity to perform a more radical extirpation. In the inflammatory tumors and in the benign neoplasm a less radical excision is sufficient.

The study of these cases also emphasizes how important it is for the surgeon to be his own pathologist, and it also points out that for practical surgery even better cellular studies should be made as a routine on all tissues removed with the knife. I have dwelt upon this in the discussion of tumors, but in this country there are many, and some of our best operators, who do not feel that a pathological knowledge of diseases they are called upon to treat is necessary.

Martina calls his tumor a myxofibrosarcoma, yet, after reading his histological description, I am of the opinion that the tumor is a borderline one and might be called a fibromyxoma just as well as a sarcoma. Yet in the clinical history the rapid growth would suggest a more malignant connective-tissue tumor. Again, we have evidence that rapid growth is not always a positive sign of malignancy, while slow growth does not exclude a very malignant tumor, which will be brought out in the discussion of one of Adrian's cases. In Martina's patient, a cavalry officer, aged twenty years, the swelling on each side of the tendo Achillis was of but four weeks' duration. As an etiological factor we have a fracture in the neighborhood of this ankle six years before, and constant trauma while riding on horseback. The first thing to call the patient's attention to his ankle was difficulty in getting on his tight-fitting riding boot; then there was pain, more rapid swelling, some restriction of motion, and talipes equinus.

That dilated veins over a tumor may be due rather to the anatomical position than the great malignancy of the tumor is shown in this case, because the most striking feature of the picture was the dilated veins over the tumor. The mass projected from each side of the tendo Achillis, and the tendon was felt in a groove between two projecting nodules (Fig. 22). The skin was tense and red, but apparently not infiltrated. At the operation the tumor was completely encapsulated and completely removed. It was a somewhat kidney-shaped mass grooved in the centre by the tendo Achillis, lobulated, with a thin capsule. On section it was divided into regular-sized areas by fibrous trabeculae. The areas were succulent, like a myxomatous tumor. Studied microscopically, there were fibrous trabeculae noted in the gross speci-

men, and the succulent areas showed in some places distinct myxomatous tissue, zones of spindle cells, which, on the whole, showed a tendency to form fibroblasts and fibrous tissue; in places there were necroses. The cellular areas were quite vascular, and there were zones of recent and old hemorrhage.

We have, therefore, the histological picture of a distinct tumor formation of the type of fibromyxoma. Whether this should be called a sarcoma or not makes little difference; it is always better to treat them as sarcoma. If any tissue of such a tumor is left behind it will give rise to a recurrent growth, which histologically, as a rule, will be more cellular and more like sarcoma. But we must remember that we have many instances in which connective-tissue tumors of this type recur again and again, and yet the original histology of the benign connective-tissue tumor remains unchanged. The so-called fibroid tumors of the naso-



FIG. 22.—Fibromyxosarcoma of bursa. (Martina's case.)

pharynx belong to this group, and I have tissues of two myxomas which have recurred a number of times at periods of from five to seven years, and yet the last tumor is histologically just as much a pure myxoma as the first.

This tumor of Martina's, although in a rare position, is apparently the most common form of true tumors of the bursa.

Adrian's first case is an example of a malignant cellular sarcoma, yet the clinical history suggested an ordinary chronic bursitis. However, if one reads the operative note, it is quite clear that the tumor should have been recognized as a sarcoma, because at one point it had infiltrated beyond the capsule into the quadriceps femoris muscle. This patient was a male, aged thirty-nine years, and had had a swelling in the region of the prepatellar bursa for ten years. After a traumatism three years ago enlargement of the nodule was observed, yet the growth was not rapid. We have, therefore, in this clinical picture nothing to suggest

a very malignant cellular sarcoma. The tumor, the size of a duck's egg, differed from the ordinary hygroma of the ordinary bursitis in that, instead of a uniformly hard circumscribed mass there were soft and hard areas. I am inclined to think that if a more careful palpation had been made and noted, the infiltration of the tumor into the muscle could have been made out. Unfortunately it was diagnosticated chronic bursitis and excised. The slight infiltration into the muscle at one point was not considered significant and the gross pathology was not studied. The microscope revealed a very cellular, round- and spindle-cell tumor arranged about bloodvessels, perhaps a perithelial angiosarcoma. Now they found enlarged glands in the groin and further growth of the nodule left in the muscle; a second operation was performed, and then a third, but the patient died of local and general metastasis eight months after the first operation.

This is an undoubted example of a very malignant sarcoma of the bursa; one which, I think, should have been recognized at the first operation, at which time a more radical procedure could have been instituted.

Adrian's second case is of additional interest, because the clinical picture suggests a subdeltoid bursitis, which we have just discussed, yet the enlargement of the bursa proved to be a spindle-cell sarcoma (see Fig. 21). This patient has remained free from recurrence six months after operation. The patient, a woman, aged sixty years, without a history of trauma, first observed swelling beneath the deltoid, then slight weakness of the arm and some pain, but no restriction of motion. This fact—absence of restricted motion—should be looked upon as suggestive that the swelling was not a bursitis, but a tumor. Later, after a trauma, there was increase of pain and restriction of motion. The tumor occupied only part of the bursa and could be easily and completely excised.

Among the older cases tumors of the prepatellar bursa at the knee predominate, and the benign and less malignant connective-tissue tumors are more common than the cellular sarcoma. Annandale removed an osteochondroma of three years' duration from the prepatellar bursa in a male, aged sixty-three years. I have observed a similar case which could be easily diagnosticated as benign from its hardness and from the *x*-ray picture. Then there are quite a few cases of myxoma and enchondroma. Dollinger's observation is called a papilloma, but from the description given it appears to me that it may have been a chronic villous bursitis. The spontaneous rupture and fistula formation observed in this case are by no means signs of tumor. On two occasions I have observed it in chronic bursitis with villous formation. The three cases of round- and spindle-cell sarcoma reported recurred locally. Duret's case is rather unique: first, the bursal tumors were multiple and symmetrical—two under the triceps of the elbow, two over the trochanter major at the hips, and one subdeltoid. Duret calls them endotheliomas, but he describes

the cellular picture of an angiofibroma. In his case the patient was seventeen and the tumor of five years' duration. Nothing is said of the result. Millian and Morestin also report a tumor of the bursa which they call endothelioma and which was calcified, but it seems to me that they, too, are describing a calcified fibro-angioma. None of the malignant sarcomas, therefore, were cured.

TUMORS.

The problem involved in the diagnosis and treatment of tumors of the extremities are the same as in tumors elsewhere, and these problems must be discussed from two viewpoints—the general, which is included under the term “cancer problem,” and the special, which has to do with a possible neoplasm which occurs in the tissues, skin to bone, of the extremities. In view of the fact that, as compared with tumors of the breast, uterus, and stomach, the number of each kind of possible tumors of the extremities is comparatively small, it is more difficult for the individual to acquire, from his own experience, positive deductions, and until recently, even in the larger clinics, this limited experience has, to a certain extent, hampered progress in diagnosis and treatment. In *PROGRESSIVE MEDICINE*, since 1899, I have discussed the neoplasms of the extremities and given the literature. Nevertheless, there is great need in this country for a better knowledge of the already published facts, and for this reason, along with the new literature and experience, it is not out of place to repeat the more important facts which I have already published in these pages.

At the present time in the experimental world of medicine, the greatest activity is probably in the research on cancer.

Cancer Problem (Experimental). This work is going on in numerous places along three lines: the etiology of cancer, the diagnosis from specific reaction in the blood of the cancer patient, and treatment on the principle of vaccines and immunity.

At the present time the etiological factors are not established. The parasitic theory is apparently losing ground, and the so-called biological view of cancer, in which the tumor formation is looked upon as the result of specific activity on the part of certain cells, is gaining ground. In the former it was concluded that a parasite coming from the outside excited cell proliferation in the body of the animal, giving rise to neoplastic formations. In the latter view, any parasitic stimulation or association is excluded. The activity is due to the cell itself. The origin of these cells is disputed, and the etiological factor which starts up the cell activity is not yet established.

As to the origin of the cell, some authorities still hold to Cohnheim's theory (the embryological); others hold that the tumor cells are derived

from the ordinary epithelial or connective-tissue cell of the body; a few are of the opinion that the specific cells of the tumor formation enter the body from without, perhaps during fetal life.

The investigations on the etiological factors in tumors have, up to the present time, given no results which can be applied to practical treatment.

On the other hand, much has been done for *diagnosis*. The most important are the investigations of the blood in animals and man suffering with malignant tumors. Apparently there is a specific reaction in a certain number of cases which, when tested by one properly trained, can be made of immense value in the diagnosis of doubtful visible tumors and concealed neoplasms. It can also be employed to demonstrate whether the tumor has been completely removed, and to bring to life possible recurrences. These tests are at the present time not sufficiently worked out to turn the method over to the general practitioner, but in every community in which there are properly equipped laboratories this work should be investigated.

Much has been done in regard to the treatment of malignant disease along the lines of immunity, yet, at the present time, the results of this work are by no means clearly established. Nevertheless it has reached a stage which should stimulate many with the proper training to devote attention to this subject, and the results should be brought to the attention of liberal and philanthropic capitalists, who may be induced to contribute to research funds.

Cancer Problems (Practical). At the present time the clinical physician and surgeon still have the responsibility of treating tumors along the usual established lines, and until the experimental investigation has established a more certain treatment, we must continue and try to improve methods already established.

The practical problems in tumors of the extremities do not in general differ from tumors elsewhere.

There is no doubt that apparently innocent tumors which have been small and quiescent nodules for years may suddenly grow, and when removed show the histological characteristics of a sarcoma or carcinoma. These observations emphasize the statement so frequently made by me in *PROGRESSIVE MEDICINE*, that apparently innocent tumors, with few exceptions, should be removed. One must have a knowledge of such tumors in order to know the extent of the local operation and whether the neighboring lymphatic glands should be excised.

In the distinctly malignant tumors the surgeon should have a proper conception of the local growth, the difference of this growth in cancer and sarcoma, the relation of the growth to the neighboring tissues, and the lymphatic glands.

Until surgeons are able to recognize the different inflammatory and neoplastic tumors from their clinical appearance, or their gross path-

ology, or from a rapidly frozen section, it will be impossible for them to give all their patients the benefit of a removal which will insure the best probabilities of a permanent cure. Surgeons, therefore, must be their own pathologists.

To improve the results in the operative treatment of tumors, there must be greater publicity along proper lines. The public must be educated as to the vital importance of seeking medical advice the moment they observe any swelling. The general profession must be impressed by actual published reports from the large surgical clinics of the world that carcinoma and sarcoma can be permanently cured by an earlier radical intervention.

When tumors and inflammations of all kinds come to surgical treatment in the onset or early period of their development, a clinical diagnosis, until the blood test has been established, becomes more and more difficult. For this reason we have no alternative except the exploratory incision, and, as experience has positively proved that the operation must follow immediately, the surgeon must be prepared to make the proper diagnosis from the naked-eye appearance of the tissues exposed, or from a rapid frozen section.

In tumors of the extremities there is always the additional problem of deciding whether the neoplasm in question can be as radically removed without amputation, and with the preservation of the function of the limb.

In PROGRESSIVE MEDICINE all these problems have been discussed from time to time since the first number in December, 1899, but I shall attempt again to present the subject of tumors of the extremities based upon a larger accumulated experience and a further study of the literature. One, however, interested in this subject will derive greater benefit from this restatement by a careful reading of what has been published before, chiefly in the December numbers, between 1902 and 1907, inclusive.

Recent Literature on Experimental Work on the Cancer Problem. Crile¹ in his address on "Surgery" at the Fifty-ninth Annual Session of the American Medical Association in Chicago, June, 1908, selected for his subject the cancer problem. The summary of his paper is expressed in the contents of the journal as follows: "Surgery has all but conquered the infections; the cause of cancer is still unknown; benign growths predispose to cancer."

Crile gives his experience with the hemolytic tests for cancer in the human being for diagnostic purposes. He records himself in favor of more radical procedures in the operative treatment of tumors, emphasizes the importance of early recognition and treatment, and states that there is a possibility of utilizing for the cure of cancer the im-

¹ Journal of the American Medical Association, June 6, 1908, i, 1883.

munity principle through transfusion of blood. In a second contribution Crile, with Beebe, of New York,¹ gives his experience with the transfusion of blood in the transplantable lymphosarcoma of the dog. This contribution should be read in the original, because it records some evidence of definite results in animals. The possibilities of treating human tumors along similar lines remains to be determined.

There are numerous contributions in regard to the transfusion of blood in animals and human beings, as to its dangers, indications, and contra-indications. A very recent one has just appeared by John Funke,² pathologist to the Jefferson College Hospital. His experimental work demonstrates that careful hemolytic studies should be made before performing transfusion of blood between human beings.

Kelling,³ a clinical surgeon in Dresden, has found time to do some very good experimental work on the hemolytic reaction of the blood serum in malignant tumors and its relation to diagnosis in practical surgery. Kelling summarizes his results as follows:

1. There are cancer patients who give a hemolytic reaction with blood corpuscles of certain vertebrates of those species the embryonal cells of which enter the human body in a living condition.

2. The reaction is constant and independent of the change in nutrition.

3. The reactions given by the primary tumor are also obtained from recurrences and metastases.

4. This reaction disappears with the radical removal of the tumor.

5. The same reaction can be obtained by the injection of the tumor mass into animals.

6. The reaction shows peculiar biochemical relations, which correspond to those obtained from the injection of embryonal cells of vertebrates.

7. These reactions are incompatible with Cohnheim's theory.

8. The hemolytic reaction gives exactly the same results as the precipitin test.

9. Under the necessary precautions concealed malignant tumors can be diagnosticated from the hemolytic reaction.

10. Through the employment of this reaction in clinical surgery, new data may be ascertained in the tumor problems.

In the second contribution by Kelling,⁴ after further experience, he again affirms his belief in the biochemical reaction. Rosenbaum,⁵ from an experience with seventy cases of malignant tumors, confirms Kelling's conclusions.

Paus⁶ tested Kelling's biochemical reaction in sixty cases with positive results in 65 per cent.

¹ *Journal of Medical Research*, June, 1908, xviii, 385.

² *Therapeutic Gazette*, July 15, 1908, xxxii, 457.

³ *Archiv f. klin. Chir.*, 1907, lxxx, 77.

⁵ *Centralbl. f. Chir.*, 1907, xxxiv, 1271.

⁴ *Ibid.*, 1908, lxxxv, 302.

⁶ *Ibid.*, 1908, xxxv, 395.

Simon, of Baltimore, has developed a hemolytic test for the diagnosis of cancer which will be published shortly in the *Journal of Experimental Medicine*. The most comprehensive *resume* on the etiological factors in the cancer problem is presented by James Ewing.¹ Here the parasitic theory, the theory of cell anatomy, and the modern biological and biochemical study of tumors are carefully discussed with the best literature.

The Relation of Trauma to Malignant Tumors. This has been a subject which excited the interest of the profession practically from the beginning of medicine. As a general statement, there is a more definite relation between trauma and sarcoma than carcinoma, and perhaps of all tumors this association is most marked in sarcoma of bone. The subject has another important phase, that in relation to accident insurance. This problem is very thoroughly presented by Jeanbrau,² and there are other interesting contributions by Löwenstein,³ Vogel,⁴ Herzfeld,⁵ and Ropke.⁶

I give these references because on a number of occasions I have been asked whether the relation between trauma and tumor is sufficiently determined for a physician to testify that a patient receiving a trauma, with subsequent development of a tumor has a right to demand damages for the tumor. At the present time I think it can be stated that in sarcoma of bone, especially the giant-cell sarcoma, such an opinion can be given in the affirmative. On one occasion I have given such an opinion, and the defendant corporation paid the patient. It was a giant-cell sarcoma of the lower end of the radius, developing some months after Colles' fracture.

In view of this possible relation between trauma and malignant tumors, we have further reason for removing all innocent nodules which are in a position in which they receive repeated traumatisms: in extracting teeth that irritate the gum or cheek; in advising against any occupation or habit which is associated with continuous trauma at any one point; for example, continuous smoking on one side of the mouth. Other examples I have previously given.⁷

In the examination of malignant tumors one should avoid traumatism. A large class of students should not be allowed to palpate a single tumor in an individual. Nothing should be done to such a tumor more than is absolutely necessary for diagnosis. The complete extirpation should be performed as quickly as possible after the first examination. Aspiration and exploratory puncture are contra-indicated. Surgeons see numerous examples of rapid growth in tumors after trauma.

¹ Archives of Internal Medicine, February 15, 1908, i, 175.

² Centralbl. f. Chir., 1908, xxxv, 687.

³ Beiträge z. klin. Chir., 1906, xlviii, 780.

⁴ Centralbl. f. Chir., 1908, xxxv, 477.

⁵ Ibid., 861

⁶ Archiv f. klin. Chir., 1905, lxxviii, 201.

⁷ PROGRESSIVE MEDICINE, December, 1907, p. 196.

Lanz¹ gives a very interesting observation in which, apparently, traumatism produced a rapid growth in a latent carcinoma. His patient had had no sign of malignant tumor when he was operated upon for a femoral hernia; at the operation no cancerous glands were found in the groin. Of course, at such an operation one would not expect them nor look for them, and it is very easy to imagine that they could be overlooked. Frequently surgeons make a complete dissection of the neck, axilla, or groin, and find cancer only after a microscopic study of the small glands. Two months after the operation the patient returned with an indurated mass in the scar which felt like, and proved to be, cancer. Further observation demonstrated that the patient had a cancer of the stomach and metastasis to glands in the opposite groin. Lanz is of the opinion that the traumatism at the operation for hernia excited a more rapid growth in the glands in the left groin.

Classification of Malignant Tumors. Ewing² writes, at the end of his article on the cancer problem, as follows: "I am strongly of the opinion that information of fundamental importance in this field is still to be obtained by very minute observation and analysis of the general and local conditions surrounding the early stage of cancer. This is the exclusive opportunity of the clinician, medical, surgical, and special, but it is often neglected. In it lies the chief hope for the present generation, of the reduction of the mortality from cancer, by the earlier recognition of the precancerous stage of the disease and the elimination of some of its accessible factors."

Along with the research work on the etiology, hemolytic diagnostic tests, and vaccine treatment of malignant tumors, the practical physician and surgeon must attempt to improve his methods of observation of tumors. This can best be done by careful clinical records, appropriate surgical procedure, thorough histological examination of the tissues removed, and records from year to year of the ultimate results. As material accumulates there is no doubt in my mind that the surgical treatment of benign and malignant tumors will be placed upon a more scientific and certain basis.

There is much need for a more scientific classification of tumors, and better technique to allow a more careful microscopic study of the cellular pathology. Mallory³ presents a contribution to the classification of tumors in which he urges, first, that small pieces of the tumor be placed at once in some hardening fluid, while the tumor is still warm and there has been no opportunity for degeneration. Tissues prepared after the manner which he describes in detail give not only a better cellular picture, but allow the investigator to study the intercellular connective-tissue fibrils. It is Mallory's hope and opinion that a classification based not only upon the character and arrangement of the cells, but

¹ *Centralbl. f. Chir.*, 1908, xxxv, 572.

² *Loc. cit.*

³ *Journal of Medical Research*, January, 1905, xiii, 113.

upon the character of the intercellular connective-tissue fibrils as well will be of practical value in estimating the malignancy of tumors. Guthrie McConnell,¹ from the St. Louis Skin and Cancer Hospital, gives his results after the examination of 100 growths for the presence of epidermal fibrils.

There is no doubt in my mind that the ordinary technique of preparing tumor tissue for microscopic study is inadequate, and surgeons interested in this department should at once study Mallory's methods and adopt them in their laboratories. Christian² says: "In pathology the advances by which our knowledge of any subject is obtained often take the form of a wave, an epidemic occasions renewed interest and furnishes abundant fresh material; a new technical procedure stimulates investigation and invites reëxamination of accumulated material. The result is a series of contributions revealing new facts concerning the subject."

The newer methods of Mallory, I trust, will have this stimulating effect on a more thorough microscopic study of the cellular and intercellular histology of tumors.

For years (since 1892) I have been collecting in the surgical pathological laboratory of Dr. Halsted's clinic of the Johns Hopkins Hospital, tumor material, not only from the operating room of the hospital, but from other hospitals in Baltimore, and whenever I could get it from friends interested in the subject. It has been my endeavor to record with each individual case the clinical history, the extent of the operative procedures, and, from year to year, the ultimate result. With each specimen we have attempted to make a careful gross and microscopic description. A large material has accumulated, and from this we have been able to make at least a working classification. By such a classification I mean one upon which the operating surgeon can base the extent of the dissection. The results of these investigations have been published from time to time in this and other journals. However, I am convinced that the time is ripe for improvement in technique. The most important factor is to get a piece of the tissue immediately into Zenker's fluid; practically this is a very difficult thing to have done, except by the surgeon who is interested in, and follows, the pathological examination of the tissues which he removes. Dr. Evans, a recent graduate of the Johns Hopkins University, in studying the histology of the wall of the large intestine during an investigation of the pathology of Hirschsprung's disease, found that autopsy material was not suitable, and that unless the tissues exposed during life were immediately, while still warm, placed in Zenker's solution, one could not get a proper section for microscopic study. He showed me the difference between the two, and there was no question as to the value of fresh material.

¹ Journal of Medical Research, July, 1908, xix, 66.

² Journal of the American Medical Association, September 5, 1903.

Tumors of the Extremities. The difficulty that I have found in properly presenting this subject from year to year is due to the great variety of the possible neoplasms and the small number in any single group. The least difficult have been tumors of bone.

There are a few points which need prominent emphasis. It should be the routine practice in the malignant epithelial tumors of the extremity to make a much wider local excision and to perform complete extirpation of the lymphatic glands, whether they be palpable or not. In the malignant tumor from a congenital pigmented mole, the extirpation should be of great extent; it should include the tumor and its surroundings, fascia over the muscle, and all the tissue in one piece, including the lymphatic glands. The less malignant tumors—warts, moles, fibrospindle-cell tumors, and the myxoma—should be given a wider margin in the local excision. In looking over the cases from the large German clinics and those in this country, one is surprised that surgeons who practise wide local extirpation with the neighboring glands in carcinoma of the breast, lip, and tongue have failed to do it, with rare exceptions, in carcinoma of the extremities. They will amputate for carcinoma in a burn, but they do not remove the neighboring glands.

EPITHELIAL TUMORS. The occurrence of benign and malignant tumors on the extremities, as compared with other regions like the lip, tongue, breast, etc., are so infrequent that one is given, perhaps, a better opportunity to study the etiological factors. An epithelial tumor arising from the skin of the extremities is unique, except in scar tissue, ulcer, fistula, sinus, eczema, psoriasis, keratosis of all kinds, x-ray burn, a benign epithelial wart, or a congenital or traumatic epithelial cyst; that is, the etiological factors—congenital tumors, trauma or chronic inflammation—are practically always present. These facts are borne out in all the published statistical investigations from large clinics, and in my experience with twenty-seven epithelial tumors of the lower extremity and twenty-nine of the upper extremity.

Steiner,¹ in his statistical studies of the carcinomas in the surgical clinic of Professor Dollinger, in Budapest, reports their observations of epithelial tumors of the extremities, confirming the above statements. This report is of special interest, because in this clinic they have made it a routine practice to extirpate the lymphatic glands in every case.

All epithelial tumors arising in the extremities are by no means malignant, and one should be able to differentiate, because for the benign local extirpation is sufficient. However, should the microscopic examination reveal an unsuspected epithelioma spinocellulare malignum (squamous-cell epithelioma) a second operation should be performed for the removal of glands. I have in the surgical pathological laboratory a small ulcer, 1 cm. long and 5 cm. wide, which was removed from the

¹ Deut. Zeitsch. f. Chir., 1906, lxxxii, 363.

chest wall near the axilla. It should have been recognized as malignant from the wide zone of induration about a very small ulcer. The microscope demonstrated a malignant squamous-cell epithelioma. Three years later this patient returned with involved glands in the axilla, and was not cured after their total extirpation.

The possible origin of epithelial tumors is so varied that at first it is very confusing. There is the epidermis, the epithelium of the hair follicle, the sweat glands, and the sebaceous glands, the epithelial cyst beneath the epidermis which may arise from congenitally misplaced spinal or basal cells, and the strictly traumatic epithelial cyst which is due to the displacement, by a traumatism, of epithelium beneath the epidermis (practically transplantation), with later growth and development of tumor.

The epithelial growths of the epidermis present themselves as warts, papillomas, corns, or rough areas covered with a scab, which have been called keratoses. This keratosis may be senile, or due to the internal administration of arsenic or lead, or from the external irritation of the x -rays or other repeated irritants. In all of these growths of the epidermis the epithelial papillary body is enlarged and grows down into the connective tissue of the corium. The hornified layer of the epidermis, except in the papilloma, is greatly thickened. In a very few cases the hypertrophy of the epithelium is composed chiefly of the basal cells.¹ Histologically, as long as we can see a definite arrangement of the basal epithelial cell on the connective tissue beneath, the lesion is benign. When these basal cells have disappeared and transitional and hornified epithelium can be seen to have broken through and begun to invade the connective tissue, the lesion must be looked upon as histologically malignant.

As a rule, we can recognize by the clinical appearance of the epidermal growth the malignant change. The surface of the wart, papilloma, corn, or the keratotic area shows increased secretion, sometimes a definite ulceration, and there is more induration at the base. In the early stage, however, these changes may be produced by infection, so that the differential diagnosis can only be made after the tumor is removed.

Recent literature on the cancer problem and the clinical studies all emphasize the vital importance of looking upon these apparently innocent epithelial growths with greater concern. They may represent the pre-cancer stage. These tumors, therefore, should always be excised sufficiently, and a most careful microscopic study made by the modern technical methods. From my experience I am of the opinion that today we are not always in a position to make a positive deduction whether these early epithelial growths are benign or malignant, and in case of

¹ PROGRESSIVE MEDICINE, December, 1904, Fig. 17, p. 149.

doubt it will be wiser to perform a more radical local operation. As to the removal of the neighboring lymphatic glands, I am also of the opinion that it will be safer to perform this operation, which, in the groin and the axilla, is not a mutilating one and adds practically no risk to the operation.

Epithelial tumors arising from the hair follicles, sweat glands, and sebaceous glands are very infrequent. In the literature we find reports of isolated cases only. In the hair-follicle tumor the first sign is an accumulation of epithelium about the hair; later, an induration. The sweat-gland tumor presents itself first as a flat, saucer-like area of induration, while the sebaceous-gland tumor is more apt to be spherical. Ulceration of the thin epidermal covering, except in the hair-follicle tumor, is almost a positive sign of malignancy; in the latter it may be due to infection.

The epithelial cysts of traumatic or congenital origin appear as subcutaneous nodules. Quite frequently they may become infected, and the induration of the inflammatory process may make one suspect a malignant tumor. This is especially true of the dermoid cyst. It is not at all difficult, however, if an exploratory incision is made, to recognize the malignant tumor by its thicker wall composed of densely granular white tissue.

I describe these various epithelial tumors of the extremity because in practically all of the cases of definite carcinoma without a history of scar, ulcer, fistula, or sinus, we get a history of one of these different epidermal glandular or subepidermal growths which has been present and quiescent, as a rule, for years; then there is a period of irritation, followed by a period of growth, change in the external appearance, with the formation of a definite cancer, ulcer, or fungus. All of these tumors are, therefore, amenable to treatment, and probably all of them curable in their benign state. One, therefore, needs no better evidence to support the argument for their early removal.

There is one exception—the ordinary corn. It is difficult to understand why a malignant epithelial growth in the ordinary corns or callosities on the toes, fingers, hands, or feet should develop so rarely.

I have seen examples of each, and the malignant change is not at all difficult to recognize. The top of the corn or callosity becomes softer, the growth after paring is very rapid, paring produces bleeding, and the induration at the base increases.

The development of carcinoma from the epidermal edge about ulcers, fistulæ, and sinuses is a well-recognized fact, and Ribbert, in his splendid writings on newgrowths, uses these facts in evidence that carcinoma can develop from preëxisting adult epithelium, the powers of multiplication of which are increased by the new environment encountered in the down-growth into granulation and scar tissue. Nevertheless, in view of the immense number of leg ulcers, fistulæ, and sinuses, the number of carcinomas in them is comparatively small.

This possibility, however, should be an incentive to attempt in every instance the rapid healing of every wound.

If the granulation tissue of an ulcer, sinus, or fistula is carefully observed, there should be no difficulty in recognizing the beginning of a carcinoma. The patient, whose carcinomatous ulcer in the scar of a burn is illustrated in Fig. 31,¹ recognized this change himself. He was used to dressing the benign ulcer, and told me that he first noticed that the granulation tissue grew above the level of the skin and changed in color from bright red to a dirty mottled white and red; the purulent discharge was greater, and it bled less readily after traumatism. However, sometimes in sinuses, especially deep ones in osteomyelitis, and after old perforating bullet wounds,² the external portion of the sinus may not show definitely the cancerous growth. For this reason, in exploring old wounds or chronic osteomyelitis with sinuses, bear in mind the possibility of carcinoma. The white, granular, friable cancer tissue is so different from the ordinary granulation tissue that there should be no difficulty in recognizing it.

McGlannan³ gives a very comprehensive review of the literature of the various benign and malignant epithelial tumors of the skin and exposed mucous membranes.

One interested in these epithelial growths will find an illustration of each variety in *PROGRESSIVE MEDICINE* for December, 1904 and 1907.

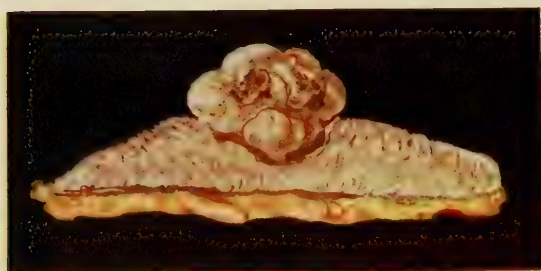
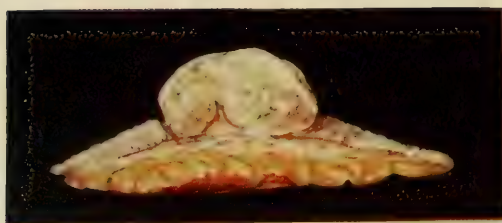
I have before me all of the cases of epithelial growths of the upper and lower extremities recorded in the surgical pathological laboratory, but as the ultimate results are not yet complete up to date, I shall postpone a more detailed discussion until next year; but practically all the points which I have just discussed are confirmed by the study of these cases, and this study agrees well with the available published material from the large German clinics. Unfortunately the malignant tumors predominate. We are seldom given an opportunity to operate in the benign or early malignant stage. In the last few years the number in the latter two groups, I am pleased to find, is increasing. Practically all the benign and early malignant tumors have remained well and free from recurrence. Very few of the definitely malignant tumors have been cured, but as only in recent cases the glandular operation has been performed as a routine, and as in the older cases the patients died from glandular metastasis, we are not yet prepared to state what improvement there will be in the results after the more scientific operation. I would urge physicians and surgeons in this country to attempt to get these cases earlier, to practise more radical operations, to study the tissues with better technique, and to follow the ultimate results.

¹ *PROGRESSIVE MEDICINE*, December, 1904, p. 160.

² *Ibid.*, December, 1907, Fig. 14, p. 201.

³ *Maryland Medical Journal*, vol. li, July and August, 1908.

PLATE I



Malignant tumor, skin of groin, arising in a congenital pigmented mole. Male, aged thirty-eight years; growth, three years. (Original, Bloodgood.)

BENIGN AND MALIGNANT MOLES.¹ Since the discussion in *PROGRESSIVE MEDICINE*, I have again carefully gone over the literature, and all of the cases recorded in the laboratory. Through the courtesy and help of colleagues I have been able to get tissues and records of many patients treated by surgeons in different parts of the country. Up to the present time I know of no positive cure of the malignant tumor arising in the congenital pigmented mole (Plate I). Further experience, however, has demonstrated that the duration of life may be much longer. In the first group of fourteen cases which I studied the average duration of life was less than one year. Since then I have records of patients who have lived four years since the onset of glandular metastasis. Another fact has impressed me: I know of no case, except a recent one of my own, in which the surgeon has deliberately performed an extensive local extirpation of the malignant tumor and the neighboring lymphatic glands before these glands were at all palpable.

In the literature and in the cases of which I have records, these malignant tumors in congenital pigmented moles have appeared in the following groups: The patients have sought advice because of a metastatic tumor, not having observed any change in the mole, or they have come complaining of growth in the mole, with definite signs of metastasis. Of course, these are hopeless cases. Then there is a third group: a mole which has shown signs of growth, perhaps with ulceration, has been removed, and the patient seeks advice because of metastatic glands in the groin or axilla. Recent experience in this group gives a ray of hope. In a few cases the interval of time has been two, and in a few cases three years. Here, perhaps, if the glandular operation had been performed when the local growth was removed, there might have been some chance of a permanent cure. In the fourth group the patients seek advice because they have noticed recently a growth in the mole, usually with slight secretion from abrasion of the thin epidermal covering or definite ulceration. Here is the opportunity for the surgeon to perform an extensive local extirpation with fascia and lymphatics.

In every one of the cases recorded in the laboratory in which the malignant mole only was removed, and in which at that time there was no evidence of extension, there has been a reappearance of the melanotic tumor in the neighboring lymphatic glands. In many of these cases secondary operations have been done—up to the present time with not a single cure. The interval is usually short, but may be long. I have observed one case in which this interval was three years. In all of the cases of which I have records, and which, from the clinical appearance and microscopic study, have been, as far as we are able to ascertain, benign congenital pigmented moles, there have been no deaths and no

¹ *PROGRESSIVE MEDICINE*, December, 1903, pp. 149 and 151; December, 1904, p. 174; December, 1905, p. 260; December, 1907, pp. 205 and 211.

recurrences after extirpation. There is, therefore, no doubt of the benignity of the congenital pigmented tumor. We must learn to recognize the early malignant stage, and then perform the more radical operation.

In a recent case (Pathol. No. 9063) sent to me by Dr. W. M. Babb, of Keyser, West Virginia, there was situated on the median surface of the right thigh, in the lower third, a distinctly melanotic tumor; there had been some growth in this congenital mole for at least three years; when the signs of malignant change appeared, I could not ascertain. The tissue removed is illustrated in Fig. 23 and Plate II. The tumor was first circumscribed with a wide zone of skin; the linear incision carried down to the knee and up to above Poupart's ligament; skin flaps were dissected back; now all the subcutaneous fat and the fascia covering the anterior and median-lateral muscles, with the glands of the groin, were dissected from without and from within toward the great vessels; then

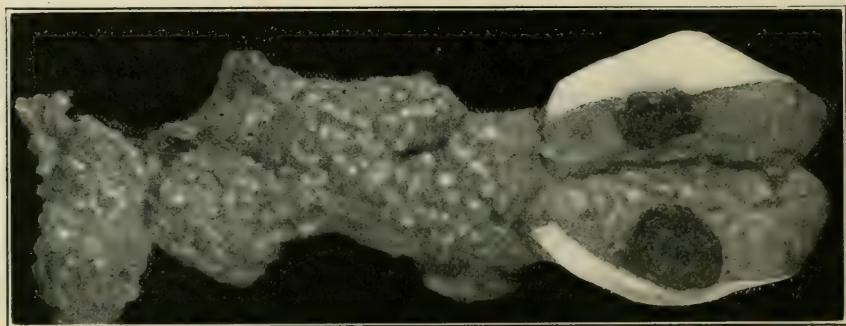


FIG. 23.—Melanotic sarcoma, skin of thigh showing extent of dissection. The appearance of the tumor is shown in Plate II.

the sheaths of the vessels with their lymphatic supply were removed. This tissue was excised in one place, leaving behind the greater artery and vein and the naked muscles.

I have never before performed such an extensive dissection of the thigh and groin. On account of the thickness of the subcutaneous fat it was possible to close the wound with very little temporary rubber-tissue drainage. The healing was uninterrupted, and the patient, after being up and about a week, left the hospital two weeks after operation, with very little lymphatic edema. Up to the present time we have been unable to demonstrate metastases. The tumor is an alveolar melanotic sarcoma (so called) arising from a congenital pigmented mole. Mitchell, of Washington, informs me that he has performed a similar dissection in which the glands were involved, and this patient has remained well up to the present time, three years since operation. The mole was situated in the groin, but he does not know how long the glands had been palpable.

PLATE II



Sarcoma of skin of the thigh, showing section of fresh lesion. See Fig. 23 for extent of removal

The congenital pigmented mole and the malignant tumor which arises in it belong to a group by themselves. The consensus of opinion is that the cells are of epithelial origin, misplaced early in embryonic life, and that the tumor is really a carcinoma.

Babler,¹ in a paper entitled "Malignant Degeneration of Warts and Moles," reports in detail eighteen cases, with these conclusions:

1. The laity should be impressed with the danger of permitting warts and moles to grow, and should be urged to have them excised at once.

2. The early excision of apparently harmless warts and moles will save days of suffering; in many instances the life of the individual will be saved thereby.

3. The moment that warts and moles begin to grow they are almost invariably already malignant growths, and should be treated as such.

BENIGN AND MALIGNANT CONNECTIVE-TISSUE TUMORS. The varieties among the benign connective-tissue tumors are unusually numerous, and they resemble pretty closely the different forms of connective tissue—the lipoma, the myxoma, the osteoma, the fibroma, and the angioma are names which explain the histological appearance of the tumor. The lipoma and osteoma, as far as I am able to ascertain, never become malignant, although both contain the fixed connective-tissue cells and the endothelial and perithelial cells of vessels which might give rise to sarcoma. On the other hand, the fibroma, the myxoma, and the angioma have a distinct tendency to become malignant. Between these three tumors and the sarcoma there is a group of cellular fibromas and myxomas which are very difficult to distinguish histologically from sarcoma. I have hopes that with the new technique of Mallory further light will be thrown upon this group of border-line connective-tissue tumors.

There is a group of mixed connective-tissue tumors called fibrosarcoma, myxosarcoma, and perhaps angiosarcoma. Some of these are distinctly border-line tumors; others have such an undoubted picture of cellular sarcoma that there is no difficulty in recognizing them.

When we come to sarcoma we still have to adopt the classification of angiosarcoma and simple sarcoma. To the former belong the lymph- and hemangio-, endo- and perithelial sarcoma. To the latter belong the spindle-, round-, and giant-cell sarcoma. This classification, adopted by most of the modern text-books on pathology and by most surgeons interested in the pathology of tumors, is of practical value from the standpoint of treatment and prognosis.

The malignant connective-tissue tumor differs from carcinoma in its local growth. It is more circumscribed. The chief cause of death from sarcoma after operation is due to the metastases by way of the blood which have taken place before extirpation.

¹ Journal of the American Medical Association, April 18, 1908, i, 1236.

There is room for a great deal of investigation along lines of better technique in the connective-tissue tumors, but my own experience, and what I am able to find in the literature, demonstrate that unusually good results follow a proper local excision of certain varieties of sarcoma, while in the other varieties recorded cures are very infrequent.

The results after excision of the border-line tumors, properly removed, are uniformly good. In the mixed sarcomas to which I have referred above as the fibro-, myxo-, and osteosarcoma the number of deaths from internal metastasis after excision is small.

The giant-cell sarcoma, which must be looked upon as a distinct entity, is almost benign. It occurs chiefly in the medullary cavity of bone; it is quite a common form of epulis, and now and then occurs as a periosteal growth. In a very few instances it has been found as a tumor of the soft parts. In the fibroma or fibrosarcoma of the tendon sheath giant cells are often found, but the tumor is not a pure giant-cell sarcoma. Giant cells may be found in the mixed spindle- and round-cell sarcoma, but their presence, even in fair numbers, does not place this tumor with the giant-cell sarcomas.

The prognosis for the angiosarcoma is, perhaps, the worst. Metastases by the bloodvessels, and, in some cases, even through the lymphatic glands, are very early. In my own experience and in the literature I have been unable to find an example of a definite cure. The different forms of round- and spindle-cell sarcoma, as regards prognosis, are not quite as bad as the angiosarcoma. Each year I have been able to find isolated cases of permanent cures. A case which I¹ have reported in a child, aged six months, has apparently been cured now, eighteen months since operation. The diagnosis rests between a vascular round-cell sarcoma and a perithelial angiosarcoma.

In practical surgery one must have a working knowledge of these benign and malignant connective-tissue tumors. Seen early, a differential clinical diagnosis is almost impossible. The nature of the tumor can only be properly recognized when exposed. I have dwelt upon this feature in practically every one of my yearly contributions. Without this pathological training surgeons will frequently perform mutilating operations for tumors which could have been permanently cured by an operation without mutilation, and mutilation (amputation of the extremity) will also not always be done when indicated. In the treatment of these tumors there is much more than the decision between amputation or not. When the tumor is to be excised without amputation of the limb, our methods of local extirpation should be extended. The subcutaneous dissection should be greater, the fascia and sheaths of muscles should always be removed, and when the fascia is involved the muscle should be sacrificed. In a series of large intracanalicular myxomas of

¹ PROGRESSIVE MEDICINE, December, 1907, Fig. 21, p. 209.

the breast in which, in my experience, sarcomatous areas are always present, I found in studying the cases treated in Dr. Halsted's clinic that in the first three in which the tumor and breast only were removed there was local recurrence in the pectoral muscle and death from direct pleural infiltration. Since this experience, in all such cases the pectoral major muscle has been removed, and there have been no recurrences or deaths in a series of six in which three years or more have passed since the operation.

What Halsted has demonstrated in his method for carcinoma of the breast, and Crile for carcinoma with involvement of the glands of the neck, and what I have advocated for cancer of the extremities, should also be applied to the more malignant groups of sarcoma. If this is done, I am convinced that the results will be better.

HEMANGIOMA AND SARCOMA. The number of cases in which sarcoma has formed in a benign hemangioma, as far as I am able to ascertain, is relatively small. Davis,¹ whose monograph on hemangioma of the muscle I have discussed, was unable to find an example. In the congenital nevi of the skin sarcomas do now and then develop. In the four cases which I have observed the tumor has always been a perithelial angiosarcoma. In these cases the patients observe first an enlargement in the nevus; then the thin epidermal covering ulcerates and a fungus forms.² None of these patients were cured.

In certain forms of both congenital and acquired skin and subcutaneous hemangiomas the benign growth may produce an ulceration of the skin and resemble clinically a sarcoma. Such cases are very difficult to distinguish from sarcoma. In these tumors, whether ulcerated or not, perithelial and endothelial cells may show so much proliferation that it would be hard to tell them at first sight from an angiosarcoma. Then there is another and very interesting group in which there is a distinct connective-tissue hypertrophy between the endothelium-lined spaces, colored yellow, light and dark red with recent and old hemorrhage. The fresh section of the tumor looks almost like liver. This group is also hard to distinguish from sarcoma.

I have previously reported, with illustrations, examples of this so-called elephantoid hemangioma or fibrohemangioma.³ Borchard⁴ reports an example of such a tumor, describing it as angiosarcoma or a peculiar tumor formation arising from varicose veins of the leg. In its gross appearance the tumor is remarkable, almost unique from its wing-shaped appearance (Fig. 24). It was 20 cm. long and had a pedicle the size of a child's arm, springing from the dorsum of the foot at its junction with the leg. The tumor tissue extended to the fascia only, and the pedicle contained numerous large veins, communicating

¹ Loc. cit.

² PROGRESSIVE MEDICINE, December, 1903, p. 149.

³ Ibid., December, 1903, Fig. 17, p. 155; December, 1907, Fig. 20, p. 208.

⁴ Archiv f. klin. Chir., 1906, lxxx, 675.

with the varicose veins of the leg. The epidermal covering had recently ulcerated, and the patient was anemic from continuous hemorrhage. Borchard's gross and microscopic description corresponds with the six cases which I have studied and with others described in the literature. The variegated color of the fresh-cut section, the distinctly endothelium-lined blood spaces plugged with degenerated endothelial cells, the fibrocellular tissue between the blood spaces filled with old blood pigment and fresh hemorrhage are described by Borchard. He, however, interprets the new tissue between the bloodvessels as a sarcomatous degeneration. Fortunately he did not resort to amputation.

The cellular pictures, at least in the six cases which I have studied, are so identical that either none or all must be sarcoma. Yet two of these, one situated about the ankle and the other in the muscles of the ball of the thumb, were incompletely excised. In these two cases a complete

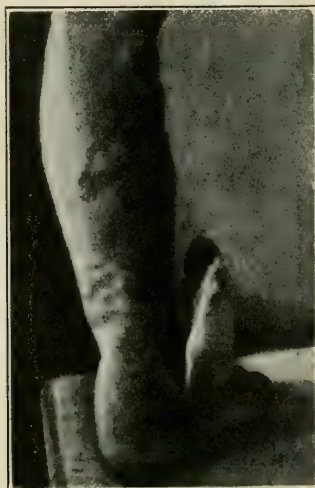


FIG. 24.—Fibrohemangioma. (Borchard's case.)

extirpation could only be accomplished by amputation. I have carefully followed these two patients six and eight years. Scar tissue has obliterated the remainder of the tumor, and the lesion is cured.

Angioma and the elephantoid angioma may present such diffuse growths that complete extirpation could only be accomplished by amputation, or, when situated elsewhere, by mutilation. A knowledge, therefore, of these tumors, their benignity and their curability by inflammatory processes will allow the surgeon to restrict his operation. In Suter's intermuscular hemangioma of the leg, I¹ am of the opinion that amputation was unnecessary.

In angioma of the skin where excision would be mutilating, the vas-

¹ PROGRESSIVE MEDICINE, December, 1905, Fig. 25, p. 244.

cular tumors can be destroyed by radium,¹ the Paquelin cautery, liquid air, or carbon dioxide snow.² All but the Paquelin can be employed only for cutaneous nevi. Radium, of course, is expensive, and the results seem to be no better than from Pusey's cheaper and more accessible material. I have had some experience with liquid air, but it is expensive, difficult to get, and lasts but forty-eight hours. It is employed, however, extensively in the skin clinics in New York where the liquid air can be readily obtained from the Westinghouse Company. In view of Pusey's results, surgeons should hesitate to operate on extensive superficial nevi without trying the carbon dioxide snow first. In the operative treatment the Paquelin should be more extensively employed. This will allow a less radical extirpation, and the inflammatory tissue excited by the burn will give a better assurance against recurrence. In fact I am of the opinion that the Paquelin cautery will have a larger field in the future operative treatment of certain tumors.

Pasini³ reports a very interesting case of congenital angioma of the skin containing muscle (angiocavernous myoma).

LYMPHANGIOMA, LYMPH CYSTS, AND SARCOMA. I find nothing in recent literature to add to my previous discussions. In *PROGRESSIVE MEDICINE*, December, 1903, p. 66, the lymphangiosarcomas which are rare tumors were described, and later the interesting lymph cysts, benign and malignant,⁴ were very fully considered with all the available literature. Lymphangiomas and lymph cysts are more commonly observed in the neck.⁵ Lymphosarcoma quite frequently, in its onset, begins with nodules in the axilla or groin. It is a rare disease, hopeless, but now and then one is called upon to recognize it in its early stage, and the diagnosis can only be made by the microscopic study of an excised gland.

ELEPHANTIASIS. This is a lesion of the lymphatic vessels, with secondary changes of the connective tissue, and is sometimes associated with varicose veins, lipomatosis, or multiple fibroma molluscum. In this country the lesion is rare, not, however, difficult to diagnosticate.⁶

Friedel⁷ describes a new operative treatment for varicose veins of the leg, associated with elephantiasis and ulcer. It is somewhat after the principle of Schede's method, except that instead of a single circular cut through all tissues down to the muscle below the knee, the incision begins at the external malleolus and goes up to the knee in a spiral; and, instead of a single incision, a ribbon-like piece is excised. The opera-

¹ Wickham, *Bull. de l'Acad. de Méd. de Paris*, January 28, 1908, p. 109.

² Pusey, *Journal of the American Medical Association*, 1907, xlix, 1354.

³ *Centralblatt f. Chirurgie*, 1908, xxxv, 114.

⁴ *PROGRESSIVE MEDICINE*, December, 1905, p. 249.

⁵ Nast-Kolb, *Beiträge z. klin. Chir.*, 1906, lii, 275; Paetzold, *ibid.*, li, 652.

⁶ *PROGRESSIVE MEDICINE*, December, 1907, Fig. 23, p. 212.

⁷ *Archiv f. klinische Chirurgie*, 1908, lxxxvi, 143.

tion leaves a very disfigured-looking limb, but it impresses me as a very feasible one if there is elephantiasis, associated with varicose veins and ulcer. In all simple cases of varicose veins one should practise first either simple ligation of the saphenous near the femoral (Trendelenburg's method) or excision of the vein (Madelung's method); for the latter, Charles Mayo's special instrument is convenient.

Von Frisch¹ reports a case from v. Eiselsberg's clinic, in Vienna, which is unique in many respects. The patient, aged twenty-four years, is shown in Fig. 25. This boy, of healthy parents, at the age of three years, began to have a swelling of the right leg which gradually extended up the thigh to the hip. At eight years of age the foot was not involved and he could walk. By sixteen years of age he could only work in a sitting position as a carpenter, because of the extension of the process downward involving the foot, the apparent loss of muscular power, and the increase of weight. For the last four years he has been bedridden, and there have been various decubitous ulcers and attacks of fever with

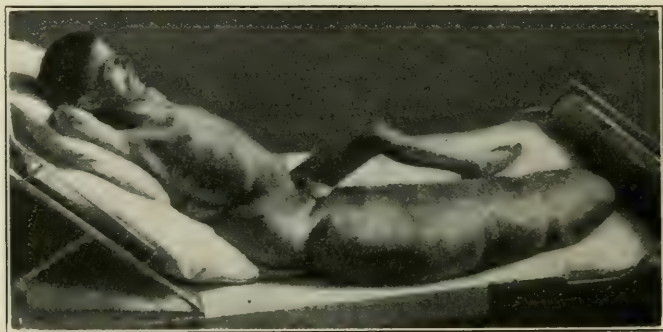


FIG. 25.—Elephantiasis. (Von Frisch's case.)

chills. The patient was emaciated and anemic, and as he died, after an exarticulation at the hip-joint, from capillary oozing due to the fact that it was impossible to amputate except through involved tissue, they were able to examine pathologically not only the limb, but also the internal organs. The autopsy, however, revealed no etiological factor. The right anterior iliac vein was hugely dilated, but there is nothing said in the autopsy as to the vessels farther up. The elephantoid process involved the right half of the scrotum, prostate, bladder, and pelvic fascia.

The entire extremity was enlarged, due to a newgrowth of connective tissue which extended from epidermis to bone. In the upper third of the thigh this tissue extended between the muscle, but lower down the muscles were replaced by it. The tendons were less changed, and although swollen and edematous, could be recognized. The knee joints

¹ Archiv f. klinische Chirurgie, 1907, lxxxiv, 153.

and ankle joints were enormously distended with fluid, which had produced a diastasis of the articulating bones. The quadriceps bursa of the knee extended to the upper third of the thigh; the synovial membrane showed folds and ligamentous tendons like the chordæ tendineæ of the heart; the bones showed atrophy, probably from pressure; the foot was in equinus position and elongated; the phalanges had practically disappeared. The bone changes are shown in Fig. 26. Microscopically, the new connective tissue invaded the nerves, vessel walls, and periosteum. This new connective tissue was rich in nuclei and elastic tissue. The case, therefore, is unique in the extensive involvement of muscle with secondary changes in bones and joints and the direct infiltration of vessel walls, nerves, and lymphatic glands. To me it is of interest from the standpoint of general pathology. We have here a very extensive hypertrophy of juicy, young connective tissue due

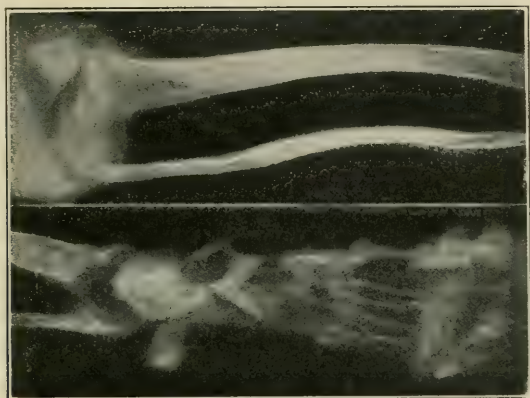


FIG. 26.—X-ray showing bone changes in Fig. 25.

to some impairment of lymph and venous circulation. It infiltrates normal tissues like a neoplasm. This connective tissue is very cellular and might be mistaken for a myxosarcoma.

In the elephantoid hemangioma which I have discussed the new tissue between the bloodvessels is of this character. Not infrequently in large connective-tissue tumors there may be, in addition, a production of new connective tissue of this character due to changes in circulation. I have also observed it in smaller tumors, which were usually pedunculated. As pathologists seldom make stains for the elastic tissue, we are not familiar with the presence or absence of this tissue in many lesions, but in this case it seems to be unusually abundant. This observation of von Frisch is unique in the literature, but I have a similar specimen in the laboratory in which the elephantiasis of congenital origin involved the entire upper extremity and axilla. The child was admitted to the clinic in the second year of life, with a streptococcus infection, and Dr.

Halsted amputated the arm at the shoulder joint. The child recovered, and is now a healthy boy, aged eight years.

Heide¹ reports a very remarkable example of extensive and multiple cavernous angiomas of the lower left extremity, involving also the gluteal, perineal, and pudendal areas, with elephantiasis. In this paper one will find a very good discussion of the extensive angiomas and their successful treatment by electrolysis.

MYCOSIS FUNGOIDES. This multiple lesion of the connective tissue in the skin remains up to the present time an unsolved problem. Like Hodgkin's disease of the lymphatic glands, and multiple myeloma of the medullary tissue of bone, it is apparently a progressive and incurable disease. Herxheimer and Hübner² report a very careful study of ten cases. They look upon the peculiar round cell in the tumor formation as specific for the disease, and are of the opinion that these cells are not lymphocytes. They also think that the combination of the x-rays and arsenic may, in some instances, accomplish a cure. Both should be energetically employed. I³ have previously discussed this lesion, with illustrations.

¹ Archiv f. klinische Chirurgie, 1906, lxxx, 827.

² Centralblatt f. Chirurgie, 1908, xxxv, 416.

³ PROGRESSIVE MEDICINE, December, 1904, p. 163, and December, 1904, p. 175.

GENITO-URINARY DISEASES.

By WILLIAM T. BELFIELD, M.D.

Gonorrhea. VACCINES AND SERA. Among the infectious diseases against which vaccines and serums have been experimentally employed is gonorrhea. The fundamental principle of the vaccine is the fact, elaborated especially by Wright, that the subcutaneous injection of dead pathogenic bacteria incites the production in the blood and tissue fluids of substances (opsonins) which so affect the living bacteria of the same kind as to make them more easily destroyed by phagocytes. The preparations of killed bacteria used for this purpose are called vaccines.

The antigenococcus serum is an entirely different agent—the blood serum of an animal (rabbit, sheep, goat) which has been repeatedly inoculated with living gonococci, whose toxins have provoked the production by the animal's tissues of an antibody, a substance that restricts the growth of the bacteria producing these toxins. The antigenococcus serum is, therefore, analogous with that brilliantly successful therapeutic agent, the diphtheria antitoxin.

Since different strains of the same bacterial species are known to vary markedly in virulence, a gonococcus vaccine, to be theoretically exact, should consist of killed gonococci from the patient to be vaccinated. Yet the time, facilities, and technical skill required for the preparation of such vaccines (autogenous or homologous) render their use possible only to those associated with bacteriological laboratories. However, vaccines have been prepared in quantity from several strains of gonococcus and placed upon the market as "stock" vaccines, and the therapeutic results hitherto reported fail to establish any distinct practical advantage for the autogenous vaccine against gonorrhea; indeed, several observers, who have noted the effects of both, assert that better results are obtained with the general than with the specific gonococcus vaccine. Thus, Hamilton and Cooke¹ state that "better results are obtained by the use of strains of gonococci that have been grown for a long period on artificial media than by the use of freshly isolated strains, and there appears to be no advantage in using the patient's own organism. Acute cases inoculated with killed gonococci from strains which had been grown for several months on artificial media improved rather more rapidly than did controlled cases which received no injections of killed gonococci."

¹ Journal of Infectious Diseases, March 30, 1908.

They also quote Cole and Meakins¹ to the effect that "it has been held by some writers that certain strains of the gonococcus are endowed with special powers in the production of opsonic immunity. Our experience has been quite to the contrary. The vaccines used by us were prepared from four different strains of gonococcus. On comparing the results obtained, no distinct difference could be demonstrated in the clinical results or effects on the opsonic index when the patient was vaccinated with a vaccine made of his or her own organism, or when a different vaccine was used."

The *clinical results* of the use of vaccines against gonorrhea have been reported by Vail,² Hollister,³ Shropshire,⁴ Teague and Torrey,⁵ Irons,⁶ Cole and Meakins,⁷ Pardoe,⁸ Hamilton and Cooke,⁹ Ballenger,¹⁰ Uhle and Mackinney.¹¹ The consensus of these reports demonstrates (1) the harmlessness of the subcutaneous injection of dead gonococci, even a thousand million in number; (2) the needlessness of employing a strain of gonococcus homologous with that of the patient—in other words, the "stock" vaccine is shown to be quite as efficient as that prepared from the subject to be treated; (3) the marked curative effect of these vaccines upon gonorrheal rheumatism, so called; (4) the failure of the vaccines materially to influence gonorrheal infections of mucous membranes in the genital tract or elsewhere; (5) the possible diagnostic value of vaccination with gonococci, to which Irons especially calls attention. He found that the injection of dead gonococci into patients harboring colonies of gonococci in the joints or elsewhere was followed by a slight rise of temperature, some increase of pain at the foci of infection, and some inflammatory reaction at the point of injection; while in subjects free from gonorrheal infection none of these phenomena were marked. He narrates several cases in which this injection was successfully used to detect the presence or absence of concealed gonococcal foci. Such a diagnostic measure would certainly prove extremely valuable in doubtful cases, just as the reaction to the old tuberculin has become a valuable diagnostic method. Doubtless some cases of "chronic rheumatism" are due to persistent gonorrheal infection, although the genital disease was apparently cured years before. Indeed, Fuller asserts that he has repeatedly cured chronic rheumatism (gonorrheal) by incising and draining the seminal vesicles.

¹ Bulletin of the Johns Hopkins Hospital, July, 1907.

² Journal of the American Medical Association, November 23, 1907.

³ Ibid.

⁴ Ibid., May 16, 1908.

⁵ Journal of Medical Research, December, 1907.

⁶ Journal of Infectious Diseases, June 4, 1908.

⁷ Bulletin of the Johns Hopkins Hospital, July, 1907.

⁸ London Practitioner, January, 1908.

⁹ Journal of Infectious Diseases, March, 1908.

¹⁰ Journal of the American Medical Association, May 30, 1908.

¹¹ Ibid., July 11, 1908.

The clinical features of vaccination against gonorrhea are so well presented by Irons¹ that the following extracts from his paper are reproduced:

"Forty cases of gonococcus infection have been studied, including thirty-one cases of arthritis. In all the cases in any way obscure the diagnosis was confirmed by the isolation of the gonococcus from the joints, and in two cases from the blood.

"In this connection it may be noted that there are many cases of obscure joint, periosteal, and synovial disease to which the term 'chronic rheumatism' is applied in which the gonococcus is the etiological factor. The remoteness in point of time of the primary infection, the peculiar clinical manifestations of the disease often simulating other affections, such as tuberculosis, arthritis deformans, or other chronic arthritic or muscular diseases, the occasional extreme latency of the infection which becomes localized in some point of slight recent trauma with no detectable constitutional disturbance, and the tendency of physician as well as patient to regard an apparently healed gonococcus urethritis as a closed incident, all combine to cloud the diagnosis in these cases.

"A typical gonococcus reaction is characterized by a rise in temperature, often only slight, an increase in pain and tenderness in the affected joints, with occasionally some increase in swelling and a variable degree of malaise. The symptoms follow the injection in from eight to twelve hours and commonly last about twenty-four hours. Frequently there is a decided tenderness at the site of the injection, greater than occurs after the inoculation of the same dose of the same preparation in normal subjects. Occasionally there is a marked redness and edema lasting from twenty-four to forty-eight hours. In a case of periurethral abscess of gonococcal origin without secondary infection, which was under surgical treatment with drainage, an injection of 500,000,000 cocci was followed in eighteen hours by a moderate swelling and tenderness at the site of needle puncture, and also marked increase in redness and tenderness about the wound. There was no coincident retention of pus or local secondary pus infection to account for the phenomenon, and the wound returned to its normal condition in twenty-four hours. There is usually a slight increase in leukocytosis in the first twenty-four hours after injection.

"The degree of the reaction is influenced by several factors. After small doses (20,000,000 to 50,000,000 in the cases in question) the reaction was not marked, and in a number of the early cases treated it either did not occur or at least was overlooked. In one case, however, in which a 50,000,000 dose was given, there was a reaction after each of the first three injections. When beginning with a small dose, gradually increasing doses were employed, the reaction did not appear so typically or was scarcely observable. When in a given case

¹ Journal of Infectious Diseases, June 4, 1908.

the same moderately large dose (300,000,000 to 500,000,000) was used for all the injections the reactions became less with each injection. In four instances the reaction followed the initial dose only.

"The most constant feature of the reaction is the increase in joint pain and tenderness. The temperature rise is often so slight as of itself to excite but little remark, especially in those cases in which there is a daily temperature of 99.5° to 100°. In opsonic terminology, the clinical reaction corresponds to the negative phase.

"As already stated, the clinical phenomena which follow the injection of dead gonococci in patients suffering from gonococcus arthritis are in many respects similar to those which follow injection of tuberculin in cases of tuberculosis. The rise in temperature and malaise are relatively less in the gonococcus infections, but there occurs in addition an increase in symptoms in the joints. In some instances there is, too, a local reaction at the site of injection with tenderness, occasionally redness, and some edema. These local signs commonly subside in twenty-four hours, although in three cases they persisted for three or four days. Great care has been taken throughout to insure surgical cleanliness in the giving of injections. Moreover, in a number of normal individuals to whom the same amount was given no local reaction was noted.

"The frequency with which these clinical phenomena occurred suggested the possibility of utilizing the reaction in the diagnosis of obscure cases of arthritis in which the gonococcus was the suspected cause. The effects of the injection of dead gonococci into patients not suffering from gonococcus infection were accordingly studied. Eight adults, in whom there was no history or sign of gonococcus infection, were given injections of 500,000,000 dead gonococci. In none of these was there any local change other than that following an ordinary hypodermic puncture, and no fever or constitutional disturbance was observed. In a case of pyorrhea alveolaris with subsequent general infection and painful swelling over the extremities there was no increase of fever or local symptoms following the injection. A case of gout with active joint involvement showed no local or general changes after a dose of 500,000,000. Leukocytes before injection, 13,200; eighteen hours after injection, 13,000. Temperature was normal throughout. A case of articular rheumatism showed no reaction after a dose of 500,000,000. There was no increase in leukocytosis and the temperature chart showed no abnormal variations. A case of acute arthritis with pericarditis was thought possibly gonococcal in origin. There was no reaction after a dose of 500,000,000. Cultures from the blood and from a small amount of clear fluid aspirated from the knee remained sterile, and the prostatic fluid contained no gonococci. The subsequent course was typical of acute rheumatic fever. In four other cases of acute and subacute articular rheumatism there was no reaction after injections of 500,000,000 cocci.

"In a number of suspected gonococcus cases the reaction was of value in making an early diagnosis. A case of mono-articular arthritis with effusion in the knee, in which gonorrheal infection was denied, was given an injection of 500,000,000. The evening temperature, which had previously reached only 100° , rose to 101.8° and the joint pains increased. The knee was aspirated and the gonococcus isolated in pure culture from the fluid. A case of chronic arthritis which had resisted all treatment was given an injection. A slight rise in temperature, with some increase in joint pains, followed. The prostatic fluid was found to contain gonococci, and the subsequent course was that of gonococcus arthritis. A patient who had suffered from extensive gonococcus arthritis had been bedridden for one year. There was practically no motion in the knees. After an injection of 500,000,000 the temperature, which for weeks had been normal, rose to 99.5° , and the patient complained of malaise and increased pain in the joints. A patient with aortic aneurysm, who denied gonorrheal infection, had been selected for control experimental inoculations. After an injection of 500,000,000 cocci, the temperature, which had been uniformly normal, rose to 100° without any other apparent cause, returning to normal the next day with no subsequent rise. The prostate was examined and found to be large, somewhat tender, and the secretion contained numbers of leukocytes with typical intracellular gonococci.

"The reliability of the clinical gonococcus reaction as a diagnostic procedure will also be determined only after many tests. It has many points in common with the tuberculin reaction, and similarly, too, there may well be cases of gonococcus infection found which do not respond. It appears, however, to be well worth a trial. Should the reaction prove to be reliable, a valuable and much-needed aid will be at hand for the diagnosis of obscure joint, synovial, and periosteal diseases."

The therapeutic effects of *antigonococcic sera* have been observed and reported by Rogers,¹ Torrey,² and Herbst,³ the last article embodying the results of the treatment of forty-five cases of gonorrheal infection at my clinic at Rush College.

Rogers states that the antigonococcus serum found best was that prepared from the sheep, and the dose of an active serum is about 2 c.c. (30 minims). This was injected into the loose subcutaneous tissue between the deep fascia and skin in the back of the upper arm, first on one side, then on the other, at intervals of from two to six days. If thorough asepsis was maintained and the serum was clear and not contaminated, suppuration would not occur. Following the local reaction there would be an increase in the joint symptoms for a few hours, which was later followed by more or less marked improvement. In cases treated early in the disease, before there had been time for much effu-

¹ Medical Record, October 26, 1907.

² Ibid.

³ Journal of the American Medical Association, May 23, 1908.

sion or anatomical changes, two or three of these injections, at intervals of twenty-four to seventy-two hours, might effect a complete cure; the urethritis, or the original source of the infection, should not be neglected as the serum had little or no effect on it, and unless the usual local antiseptic and astringent treatment was energetically carried out, a reinfection or recrudescence of the metastasis would be expected.

Patients who had had gonorrheal joint symptoms for several weeks might require a dozen or more injections, but in at least 75 per cent. of all of the acute or subacute or early chronic forms of the disease, success might be expected. The failures would be in those individuals suffering from a mixed infection, and the chronic gonorrheal joints were not helped.

Torrey says the antigonococcus serum exercised a specific curative influence in a high percentage of cases of gonorrheal rheumatism. The serum had been used in seventy patients with gonorrheal arthritis, with fifty-five, or 78 per cent., either entirely cured or much improved. In the remainder there was slight or no improvement. The average number of injections per patient was five, and twenty individuals were cured in ten days or less. Even some of the chronic cases were improved, though it required many more injections, and the improvement was tardy.

The experience of my clinic is thus recorded by Herbst:

The method of administration is by subcutaneous injection, the skin being prepared as for other subcutaneous injections. The abdominal wall was used in all cases, because the reaction which follows almost every injection is better tolerated in this part of the body.

The amount given at each injection varied from 2 to 6 c.c. The injections were given from forty-eight hours to seven days apart, depending on the severity of the reaction. A reaction follows almost every injection, appearing sometimes in the form of a slight urticaria at the site of the injection, at other times in a more severe form accompanied by a dermatitis, enlargement of the inguinal glands, rise of temperature from 1° to 2° , and an increase in the pulse rate. Most of these symptoms disappear in from twenty-four to forty-eight hours. In one case, however, the urticaria and dermatitis extended over the entire body, with a high temperature and rapid pulse, and continued for nearly five days. The absorption of the serum is rapid; the tumor which follows the injection disappears in about fifteen minutes.

Fifty-two cases, including almost every form of gonococcus infection, were injected with this serum.

Of the first group, the acute gonococcus infection of the anterior and posterior urethra, seventeen individuals were treated, receiving the maximum dose, 6 c.c., as frequently as the reaction would allow, without any change in the discharge from the urethra or other symptoms.

In Group 2, subacute gonorrhea of the anterior urethra or anterior and

posterior urethra, nine patients were injected. Eight of these did not show any improvement after repeated injections; one cleared up after the third injection.

In Group 3, chronic gonorrhea of the anterior and posterior urethra, eleven patients were injected. Seven did not show any improvement; one cleared up after eight injections given during a period of four weeks; one after six injections given during a period of three weeks, and two passed clear urine after four injections given during two weeks.

In Group 4, acute gonococcus infection of the epididymis, four were injected. Three did not improve as quickly as usually seen with local treatment. In one case the swelling subsided in two weeks without the return of the discharge from the urethra; this patient received six injections of 4 c.c. each.

In Group 5, acute gonococcus infection of joints, four were injected. Two of them were aspirated, and the gonococcus demonstrated. One patient is under treatment at the present time; three did not show much change.

Group 6, chronic gonorrhea of joints, included seven patients; all improved promptly after the first few injections (one of these had been unsuccessfully treated with vaccines elsewhere).

One of the gratifying cases of this group was the following:

CASE III.—Male, aged twenty-five years, contracted gonorrhea in 1900.

History. After months of treatment for the local condition, his right knee joint became slightly swollen and very painful. This was followed in a short time by involvement of both ankle-joints. After a course of baths at Hot Springs, his condition improved for a short time, only to be followed by an extension of the disease into almost every joint in the body. In the latter part of August, 1907, there was found a slight gleet discharge which contained gonococci in small numbers. The joint condition was so aggravated at this time that he was only able to walk by the aid of two canes. This had been his condition almost constantly for seven years.

Treatment. After ten weeks of local treatment, the urethral discharge disappeared, but with only a slight improvement in the joints. November 21 he received the first injection of serum; 2 c.c. were given, followed by a second injection of 4 c.c. at the end of forty-eight hours. The following day he developed a slight urticaria at the site of the injection and was somewhat improved. A third injection of 6 c.c. was given November 27, followed by marked improvement. Two more injections of 6 c.c. each were given November 29 and December 2. On December 3 and 4 he suffered from rather a severe reaction, after which the pain in his joints almost entirely disappeared. Three weeks after he received the first injection he entered the service of one of the express companies and was able to do this work during the holiday rush, which describes the change in his condition better than can words.

These conclusions seem justified: (1) The serum has absolutely no effect on acute gonorrheal infections, whether they exist in the genital tract or in any other part of the body; (2) its value in subacute and chronic cases is very doubtful, although there were a few isolated cases in which the results were somewhat better than we see with local treatment only; (3) the value of this serum in the treatment of chronic gonorrheal joints is without question.

The present clinical status of vaccine and serum therapy against gonorrhea seems to be that both are valueless in the acute infections of the genital tract; that each is usually successful against the systemic infection (gonorrheal rheumatism); and that both have a possible, but as yet undetermined, value against the chronic infections of the deeper genital organs—prostate, vesicles, and epididymes.

For the practitioner, the stock serums and vaccines on the market, without opsonic control, seem to have quite as much therapeutic value as the laboriously prepared individual vaccines, controlled by frequent determination of opsonins. It is perhaps worthy of note that one of the cases of gonorrheal arthritis, which was promptly cured in my clinic by the stock serum that we used, had been treated without success with a laboratory vaccine which had been prepared and administered by a careful and experienced observer.

It is interesting to learn that we have been unconsciously using gonorrheal vaccines in our standard treatment of subacute and chronic gonorrheal affections; for Freeman has shown that the massage of gonorrheal joints and prostates produces the same effect upon the opsonic indices as does an artificial inoculation with gonococci—whence the inference that such massage actually dislodges and empties in the tissues colonies of gonococci from the infected joint or prostate.

PREVALENCE OF GONORRHEA. Erb¹ maintains his conservative view as to the prevalence of gonorrhea, stating that further experience has confirmed his previous figures; he has found that 51 per cent. of his last 400 male patients of all classes had had the disease, making the proportion of the total 2400 examined about uniform. The proportion of wives suffering from the consequences of the disease is even less than in his former observations.

In the discussion of *gonorrhea in women*, by the obstetrical section of the American Medical Association,² a wide diversity of opinion as to the prevalence of the disease was expressed. Johnson thinks that at least 50 per cent. of all abdominal operations done upon women are rendered necessary by gonorrhea; others thought that permanent damage by the gonococcus was far less frequent, Cullen suggesting that many pus infections of tubes and ovaries which are commonly ascribed to gonorrhea are due to appendicitis with secondary involvement of the

¹ Münchener med. Woch., July 30, 1907.

² Journal of the American Medical Association, February 1, 1908.

genital ducts. All agreed that the vulvovaginitis of children is commonly gonorrheal and very widespread.

GONORRHEAL EXOSTOSIS. Jaeger¹ refers to a painful disease of the foot due to gonorrhea. He reports a case, the seventeenth on record, with a typical exostosis, which was removed with a sharp curette. It was an ossifying periostitis; gonococci were found in the tissue.

Genito-urinary Tuberculosis. THE TUBERCULINS. The trend of treatment of surgical tuberculosis has been in the last five years distinctly toward conservatism, the knife having been largely replaced by climatic and hygienic means. It is generally recognized that the tuberculous cervical gland, joint, or epididymis is, as a rule, but one of many manifestations of an infection whose essence is a vice of nutrition. The recognized need has been for an agent which will correct this vice of nutrition, which will fortify the entire body against the toxins of the tubercle bacillus. While dry, uncontaminated air and sunshine are potent means to this end, yet their utility is obviously restricted.

In the new tuberculin, T. R., we have an agent whose therapeutic power should be extensively tested. The sensational failure of the old tuberculin, in 1891, to meet the exaggerated expectations of an uninformed profession, is doubtless the explanation of the indifference to the possibilities of the new tuberculin. Yet reports of its curative value from many sources should receive the attention of physicians everywhere.

Pielicke² considers himself cured of pulmonary tuberculosis by the use of tuberculin; and relates the symptomatic cure of bilateral renal tuberculosis with bladder infection in a woman through the same agent. This patient has remained in good health for two years.

Birnbaum³ reports the use of tuberculin in twenty-three cases of urogenital tuberculosis in women, with results that made surgical intervention needless in a number of the cases. He considers it a most valuable agent.

Wildbolz⁴ strongly advises treatment with tuberculin for bilateral and for early unilateral renal tuberculosis. While he has not seen an absolute cure, yet he has always observed marked improvement sometimes amounting to a symptomatic cure.

Walker⁵ strongly recommends this agent against tuberculosis in general, and relates considerable experience upon which this recommendation is based. Fowler⁶ takes the same ground in the annual address in medicine before the British Medical Association.

¹ American Journal of Orthopedic Surgery, January, 1908.

² Berliner klin. Woch., 1908, Nr. 3.

³ Centralbl. f. Gynäk., September 21, 1907.

⁴ Folia Urologica, November, 1907.

⁵ London Practitioner, May, 1908.

⁶ British Medical Journal, August 1, 1908.

Pogue¹ has, during several years, treated over 150 cases of tuberculosis in general with tuberculin, with distinctly better success than ever before, and comprising many symptomatic cures.

Rothschild² considers the marketed tuberculin a valuable agent, but has secured even better results in three cases with an autogenous tuberculin (from the patient's own bacilli), regulated by observation of the opsonic index.

Dluski,³ in a long article, reviews the literature of tuberculin therapeutics since the old tuberculin was introduced (seventeen years). He tabulates the results obtained by the use of each of eight varieties of tuberculin in over 1700 cases from twenty or more sanatoria. The results are by no means uniform, and the opinions of the users are conflicting. The new tuberculin seems to have given the best results; but the writer concludes that the value of tuberculin treatment is still unproved.

My own experience with the new tuberculin in the treatment of genito-urinary tuberculosis includes five carefully observed cases, as well as several others, from whom fragmentary reports have been received. These comprised one unilateral, one bilateral renal tuberculosis—both with vesical infection and severe bladder symptoms—and three of tuberculosis of the male genital tract. A gratifying result of the tuberculin treatment has been the prompt arrest of bladder irritation; thus in the case of bilateral renal infection, a female aged twenty-two years, the intervals between urinations lengthened from thirty minutes to two and one-half hours within three weeks after the treatment was begun. (This amelioration of vesical irritation has been remarked by Pielicki also.) In two of the five cases a symptomatic cure was effected; in one, a tuberculous fistula of ten years' standing closed spontaneously; in the remaining three, marked improvement, amounting to fair general health, was secured. No five consecutive cases of equal gravity have improved so much or so promptly without the tuberculin treatment in my personal experience.

These have been treated with a stock tuberculin (T. R.), without any attempt to control the administration by observation of the opsonic index. The first injections were $\frac{1}{10000}$ mg. or less, and the effort has been to avoid a febrile reaction; the intervals between injections were three to seven days.

It would seem that a convincing trial of this agent should be made, since we are warranted in hoping that it will be found distinctly our most efficient non-surgical means in repressing this infection. Possibly a course of tuberculin treatment before and after operation, when this is obviously required, may be found a valuable aid to the surgeon.

¹ Medical Record, August 29, 1908.

² Beiträge zur Klinik der Tuberkulose, June, 1908.

³ Ibid.

SUCTION HYPEREMIA AGAINST TUBERCULOSIS. This principle has been applied with benefit in the treatment of tuberculosis of the external genitals. Franck¹ has applied suction hyperemia to the testes not merely for the tuberculous infection of these organs, but also for tuberculosis of the seminal vesicles and prostate; he believes that in two of these cases no other measure than a mutilating operation could have been considered. He has apparently not used the tuberculin according to modern methods.

RÖNTGEN TREATMENT OF RENAL TUBERCULOSIS. The two cases reported by Bircher² seem more worthy of attention than do most of the reported cures of deep-seated disease by the x -rays. In both cases he advised nephrectomy; upon refusal of the operation, he exposed the kidney region to the Röntgen rays, continuing the treatment for months. In both cases the same improvement was witnessed: disappearance of pus from the urine, subsidence of fever and bladder irritation, improvement in general health, and, finally, symptomatic cure.

IODINE TREATMENT OF GENITAL TUBERCULOSIS. Durante³ has long used iodine, locally and internally, against surgical tuberculosis in general. He reports twelve cases of tuberculosis of epididymis and testicle cured by this treatment; several of these would otherwise, he thinks, have lost one or both testes. He therefore asserts that the iodine treatment restores to society men, not eunuchs. He injects a 1 per cent. solution of iodine, commencing with a few drops and gradually increasing the quantity, spreading the liquid evenly through the diseased tissues. About thirty injections are required. Iodine is given internally, and the usual restorative measures are adopted.

The Kidney and Ureter. NEPHRECTOMY FOR TUBERCULOSIS. Israel⁴ reports 97 cases, with 11 deaths; Nicolich 30, with 7 deaths; Zuckerkandl 31, with 4 deaths; Wildholz 62, with 3 deaths; Casper 52 cases, with 5 deaths; Rafin 44 cases, with 5 deaths—316 cases, with 35 deaths—a mortality of about 11 per cent. Yet many of these deaths resulted from insufficiency of the remaining kidney, whose functional integrity had not been tested with indigo-carmin or other agent. These operators report a smaller mortality in their later cases where these tests have been made in advance. Thus, Israel's last 9 of his first 47 cases, but only 2 of the last 50—18 and 4 per cent., respectively; and several others report similar decrease in their operative mortality.

The end-results of his 97 nephrectomies for renal tuberculosis, followed for fifteen years or less, are reported by Israel as gratifying; he notes especially the relief of cystitis so commonly present, and regards this fact as a forceful argument for the belief that the infection descends

¹ Medizinische Klinik, May 24, 1908.

² Münchener med. Woch., December 17, 1907.

³ Journal of the American Medical Association, April 4, 1908.

⁴ Folia Urologica, Band i, Nr. 1

from kidney to bladder. He warns that the ureteral catheter used to determine the presence or absence of tubercle bacilli in the opposite kidney may mislead; because these organisms may enter the catheters during its passage through the bladder to the ureter orifice. He considers nephrectomy the treatment of choice if the infection is limited to one kidney; in bilateral disease, tuberculin may be employed with advantage.

Wildholz has observed 121 cases of renal tuberculosis, and performed nephrectomy in 62 with 3 deaths. He finds the disease in both kidneys oftener than reports in current literature would indicate. He strongly recommends the use of tuberculin before resorting to nephrectomy, even when the infection is limited to one kidney.

CHROMATOCYSTOSCOPY. Casper² states that among 140 operations on the kidney, the only death from renal insufficiency was one in which he could not make in advance the usual tests of the functional capacity of each kidney. He states that notable delay in the elimination of color and sugar through the ureter catheter by the supposedly normal kidney, is a positive contra-indication to operation; while if the blue appears freely through the ureter catheter within eight minutes, and the sugar within sixteen minutes, the kidney is working satisfactorily, and the other may be removed without danger of uremia.

Albarran³ confirms the observation of Rovsing and others, that when one kidney is tuberculous the urine from the other often contains albumin, and sometimes casts, which, however, disappear when the tuberculous kidney has been removed, and which seems, therefore, to be the effects of a toxemia. These kidneys react well to the color and phloridzin tests, while tuberculous organs do not.

Suter⁴ discusses the value of indigo-carmin in the diagnosis of the functional capacity of the kidney. He makes an intramuscular injection of 4 c.m. of a 4 per cent. solution of the dye in normal salt solution; he has seen no evil results.

He has used this test in 119 cases—26 in which the kidneys were normal, 48 in which operation was performed (42 nephrectomies), in 21 of unilateral disease not operated (14 of these were tuberculous), and in 9 cases of chronic nephritis. Of the 48 operated cases, 2 died, the autopsy showing the remaining kidney normal, as had been predicted from the color test.

His conclusions are:

1. The healthy kidney excretes blue urine within six to twelve minutes after the injection (in 93 per cent. of the tests), sometimes as late as thirteen to fifteen minutes (7 per cent.); further delay usually means impairment of function.

¹ *Folia Urologica*, Band i, Nr. 4.

³ *Zeitschr. f. Urologie*, January, 1908.

² *Deut. med. Woch.*, July 30, 1908.

⁴ *Ibid.*, Band ii, Nr. 5.

2. A diseased kidney excretes urine of less intense color than does its healthy fellow, even when the time interval is about the same.

3. In 6 cases of hydronephrosis there was no excretion of color, though the renal parenchyma was extensive.

4. Of six tuberculous kidneys, three excreted no color, and in the other three the excretion was tardy (twenty to forty-five minutes).

With our present knowledge, it seems probable that the indigo-carmin test is a valuable factor in determining the functional integrity of a kidney, but that the phloridzin test is distinctly less reliable.

RENAL TUMORS. Küster and Eiselsberg discussed renal tumors before the German Urological Congress.¹ The former stated that this is a relatively unexplored field; that we should not neglect the older methods of functional diagnosis—quantity of urea, etc.—though the newer ones, carmine and phloridzin excretion, should be further studied. Early diagnosis is most important, since almost every renal tumor requires a nephrectomy. The transperitoneal operation is much better than the retroperitoneal, because not only the kidney but also the lymph glands, fatty capsule, and adrenal should be removed.

Eiselsberg emphasized the frequency and the malignancy of hypernephromata, and related an instance in which Billroth removed a hypernephroma, removing the last rib and opening the pleura during the operation. After ten years of health, the patient succumbed to pleurisy, adrenal tissue being found in the pleura and bronchial glands.

Both speakers condemned the exposure of the second kidney as a means of determining its functional capacity; it is a serious measure, which often fails to give the desired information.

ESSENTIAL HEMATURIA. That symptomless bleeding from the kidney, without clinical or other urinary findings, is usually due to localized disease in the cortex, is the view gaining ground with added experience. Kotzenberg reports 12 such cases operated in Kümmell's² wards since 1895: 9 were less than thirty years old, 10 were males, and 2 females. In 10 the urine showed absolutely no formed elements except blood; in 2 there were found a few hyalin casts. In 4 nephrectomy was performed (1 dying on the table), in 6 nephrotomy, and in 2 decapsulation. All were apparently cured. He regards nephrotomy and decapsulation as equally efficient, but prefers the former because it gives the opportunity to explore the pelvis with the finger. Kümmell relies upon cryoscopy of the blood more than anything else to determine the safety of the operation. The differentiation between essential hematuria (inflammation of the cortex) and tumors can often be made only through exploration.

Balloch³ saw hematuria recur with each of five pregnancies. Nephrectomy was made and the extirpated kidney showed early nephritis. Then pregnancy ensued, and the hematuria recurred.

¹ Zeitschr. f. Urologie, Band ii, Nr. 1.

² Ibid., Nr. 2.

³ Surgery, Gynecology, and Obstetrics, March, 1907.

Seelig¹ reports 3 cases of hematuria due to *appendicitis*, relieved in 2 cases by appendectomy. In one the cause of the hematuria was a toxemia; in another an adhesion of the appendix to the kidney.

Steinthal² observed a young woman who suddenly had a hemorrhage from the left kidney, continuing several days. The indigo-carmin test showed the right kidney to be functionally normal; the left somewhat inflamed. This organ was exposed and appeared normal; but five days later such severe hemorrhage recurred that the kidney was removed. Gross and microscopic examination of the organ failed to reveal anything abnormal—the sixth case recorded in which nothing was discovered in the extirpated organ to explain a severe renal hemorrhage.

Hagner³ adds to the list of such cases three in which a symptomless bleeding from the kidney ceased promptly after catheterization of the ureter. These items are noteworthy: the bleeding had lasted six weeks, six months, and thirty-five years, respectively; and the arrest had continued twenty months, three and one-half years, and seventeen months, respectively.

Yet not all are so easily controlled. In 1889 I catheterized the ureter and made a nephrotomy in a girl aged eighteen years, for essential hematuria without arresting the bleeding. In 1907—eighteen years later—I examined her again. The bleeding had continued intermittently during the entire period without other sign of ill health. I again catheterized the ureter and injected adrenalin solution without appreciable effect on the bleeding.

CALCULI AND RÖNTGEN RAY. Pond,⁴ in an illustrated article, calls attention to the close anatomical relations of the gall-bladder, kidney, and renal pelvis, and the consequent confusion of the symptoms caused by biliary, renal, and ureteral calculi. His interesting article is summarized in these propositions:

1. Kidney stone usually is found in the pelvis of the kidney and the frequency of the right kidney is 119 to 98 in the left.

2. Ureteral stone is found in 40.7 per cent., or in nearly one-half of the cases at the upper or psoas flexure.

3. More than half of the gallstones found in the common duct are located in the ampulla of Vater.

4. Both of these regions are connected with the pneumogastric distribution through the renal plexus, and this explains the nausea and vomiting during the acute seizures.

5. The pelvis of the kidney, the usual site of kidney stone; the psoas flexure of the ureter, the location of 40.7 per cent. of all ureteral stones; the fundus of the gall-bladder, the site of gallstone in more than half of all cases; the descending common duct, the distal portion of the duct

¹ Annals of Surgery, August, 1908.

² Beiträge z. klin. Chir., Band liii, Nr. 3.

³ Annals of Surgery, August, 1908.

⁴ Journal of the American Medical Association, November 28, 1907.

of Wirsung; the ampulla of Vater, which is the location of 57 per cent. of all common-duct stones; and the descending portion of the duodenum are all contained in space covered by a silver dollar, between the end of the ninth rib and the umbilicus.

6. The pain of a kidney or ureteral stone does not always radiate to the groin or bladder, but is sometimes more evident about or above the umbilicus.

It is obvious, then, that disturbance of any of these structures may produce symptoms of pathology in the adjacent structures.

The reliability of the *x*-rays in picturing renal and ureteral calculi is variously estimated; that it may fail to shadow a calculus composed of uric acid only has long been known; and the cases are becoming more numerous in which bodies pictured by the ray in the position of kidney and ureter are found to be objects extrinsic to the urinary tract.

Leonard¹ thus summarizes his extensive experience: "The *x*-rays have shown that many cases presenting marked symptoms of ureteral colic can be treated rationally and safely with the final passage and recovery of the calculus without operation. It has rendered such a course of expectant treatment rational by showing that the calculus is sufficiently small to be expelled by natural methods, and in addition that the majority of calculi are found in the ureter. Without the knowledge afforded by this method, expectant treatment is not only irrational, but also dangerous. In 31 of my cases, in which calculi have been found in the ureter and expectant treatment has been suggested, the patient has passed the calculus. In only 11 cases of ureteral calculus has operation been considered advisable. Two patients passed ureteral calculi before the indications for expectant treatment had been determined. As the proportion of renal to ureteral calculi in my series of cases and the proportion of confirmed and unconfirmed diagnoses has been misstated by misquotation, I will give the following statement:

"The total error in a series of 356 cases has been less than 3 per cent. In the last 100 cases only 1 case of error in diagnosis has been reported to me.

"A possible diagnosis of calculus has been made in 106 cases. Of these, 36 were renal calculi; of them, 30 were confirmed by the removal of the calculus, 4 of the patients refused operation, and in 2 no calculus was found. Seventy cases were of ureteral calculi; of them, 43 have been confirmed by the passage or removal of the calculus; in 27 the patients have not been operated on or heard from.

"Of 46 cases in which an exclusion or negative diagnosis was rendered, the patients were operated on and the diagnosis confirmed. In 7 cases where a negative diagnosis was rendered, operation showed a calculus to be present, while in 2 cases a mass of crystalline debris was found

¹ Journal of the American Medical Association, September 28, 1907.

filling the pelvis of the kidney. This makes a total error of 10 cases in a series extending from the formation period of this diagnosis. As has been said, in the last 100 cases the proportion of errors is materially decreased.

"There were 28 ureteral and 9 renal cases. In 2 renal cases the patients refused operation and in 7 the diagnosis was confirmed. In 19 ureteral cases the diagnosis has been confirmed by the recovery of the calculus. Of the remaining 9 cases, some of the patients are too recently examined, and others have not been heard from. Of the 63 cases in which a negative diagnosis was rendered, 42 have been confirmed by the subsequent history or operation. In 21 cases the subsequent history has not been learned."

Cole,¹ after making about 1500 radiograms for the diagnosis of renal calculi, feels justified in saying that any stone of sufficient size to justify operation may be shown by a radiogram which presents these details: the spine, the transverse processes of the vertebræ to their tips; the outer border of the psoas muscles, and the outlines of the kidneys. These details may be obtained in about 95 per cent. of the cases.

Surgeons, on the other hand, regard the *x*-ray diagnosis as quite fallible, though most valuable; and they insist upon the consideration of the full clinical and microscopic picture as well as of the radiogram. Thus, McArthur² mentions a case in which clinical and laboratory evidence indicated a stone in the kidney, but because the *x*-rays failed to picture it operation was deferred. Six months later, when the patient insisted upon an operation, an incision revealed twenty stones in the kidney. Nancrede³ removed from the bladder a large uric acid stone which several radiograms had failed to reveal.

On the other hand, there are various bodies that are easily mistaken on *x*-ray plates for kidney and ureteral stones. These are discussed by Shoemaker, Stewart,⁴ Holz knecht and Kießbock.⁵ Among these bodies are the phleboliths so often present in the pelvic veins of women especially; cheesy and chalky masses in old inflammatory exudates, particularly in the broad ligaments; calcareous pelvic glands; atheromatous plates in bloodvessels; small calcareous masses in the ends of the Fallopian tubes and in the ovaries; concretions in the appendix; ossification spots in the pelvic ligaments; concretions in the bursæ of the pelvis. As these may lie in or near the course of the ureters, they may be—and repeatedly have been—mistaken for urinary calculi. Thus, Cathelin reported to the French Urological Congress two cases in which radiograms confirmed the diagnosis of stone in the renal pelvis; at the operation no stone was found, although the patients have been well ever since.

¹ Journal of the American Medical Association, September 28, 1907.

² Ibid., May 30, 1908.

³ Ibid.

⁴ Annals of Surgery, xlv, 318.

⁵ Zeitschr. f. Urologie, Band ii, Nr. 5.

Brewer,¹ in reporting upon 140 cases of renal and ureteral operations, remarks that in only 59 per cent. of the cases operated on for suspected calculus, was a stone found (32 out of 57 cases); in 19 others some other definite lesion explaining the symptoms was discovered, while in 6 cases no lesion was detected. Twice the *x*-rays pictured an object supposed to be a stone, but these were found to be a calcified appendix epiploica of the sigmoid, and a shrunk tuberculous kidney, respectively, the latter casting a heavy, well-defined shadow as large as a walnut.

According to Brewer, 9 exploratory ureterotomies have been performed for the removal of a suspected stone. In 4 one or more stones were found, while in 4 the result of the examination was negative. All the 9 cases healed primarily without infection and without leakage of urine.

After considering somewhat in detail the subjective and objective symptoms, the results of urinary analysis with reference to hematuria and pyuria, the results of *x*-ray examination, and the results of cystoscopy and ureteral catheterization, he said he felt justified in stating that there is no single symptom or sign, or any group of symptoms or signs that is absolutely pathognomonic of renal or ureteral calculus, unless the calculus is in the lower ureter and can be seen or touched by a metal bougie or catheter. The most important factors to be considered in making a diagnosis are pain, tenderness, hematuria, the results of radiography, cystoscopy and ureteral catheterization. Pain and tenderness were present in 100 per cent. of the cases; but it should be remembered that they were present in many cases in which no stone was found. That calculus may and often does exist without pain is evidenced by the statement of Bruce Clark, who reported 24 autopsies on calculous patients, in 13 of whom there had been no subjective symptoms during life. Hematuria was present in 45 per cent. of the stone cases, but it was also present in 41 per cent. of the cases without stone. If all cases are included, the *x*-rays gave positive evidence of stone in 79 per cent. Calculous disease had been noted in both kidneys in 5 instances. There were 7 intermittent hydronephrosis cases, and in all the afebrile attacks of violent renal neuralgia was present. In all the kidney was at times palpable. In 4 the renal pelvis was found to be enlarged and relaxed; in 3 it appeared normal. One case of complete gangrene of the kidney was observed from twisting of the pedicle.

Kümmell² reports 109 operations for renal and ureteral calculus, with 3 deaths—28 nephrectomies without mortality, the remainder incisions into kidney, pelvis, or ureter. He lays great stress upon cryoscopy of the blood, with the use of the ureter catheter to determine the danger of operating on the kidney; a normal index—0.56—proves the presence of

¹ Journal of the American Medical Association, February 29, 1908.

² Zeitschr. f. Urologie, 1908, Nrs. 3 und 4.

enough renal tissue for complete excretion. When the index is below 0.60, he makes only a nephrotomy—not a nephrectomy.

Hawkes¹ removed the appendix through a low intermuscular incision, then reflected the peritoneum, and reached the ureter containing a calculus in its pelvic portion. He raised the ureter between thumb and index finger, incised it and removed the stone; sutured the ureter with chromic gut, and inserted a cigarette drain. Uneventful recovery followed.

Barrow² removed from the kidney of a man, aged forty-eight years, a stone weighing 1 pound and 2 drams; the patient had had urinary disturbance for forty years, and enlargement in the lumbar region for ten years. He recovered.

HERNIA OF THE URETER. Galassi³ reviews 15 cases in the literature in which the ureter formed part of an inguinal hernia, and relates a case personally operated on. In none was the presence of the ureter in the hernial sac detected before operation. Several patients had urinary disturbance, especially difficulty in micturition; in one retention of urine occurred. In one case the loop of ureter had dropped into the scrotum, and the kinking of the ureter had caused hydronephrosis on that side. Galassi's patient, a seventeen-year-old girl, had had a femoral hernia for years, without urinary symptoms. The ureter was recognized in the sac, and returned into the abdomen.

PROLAPSE OF URETER INTO THE BLADDER. Brongersma⁴ reports a case of this sort, the prolapsed end of the ureter resembling a cyst in appearance, from whose summit urine issued. There are 61 such cases recorded, many of them, including Brongersma's, being caused by calculi at the lower end of the ureter; 17 of these have been recognized through the cystoscope; the remainder were discovered postmortem.

Kapsammer⁵ thinks that these tumors consist sometimes of prolapsed mucous membrane only; at other times the entire thickness of the ureter is prolapsed.

The Bladder. **TUMORS OF THE BLADDER.** Frisch⁶ summarizes his personal experience—the largest yet recorded—in the treatment of tumors of the bladder. In twenty years he has operated on 300 such cases, with a mortality of 14 per cent. of the benign and 25 per cent. of the malignant cases. He has always made a suprapubic incision, with drainage through the wound.

While 201 of these tumors were papillomata, yet sections showed malignancy of structure in over half of these; hence two-thirds of the 300 tumors were actually malignant.

Frisch has succeeded in tracing 164 cases after operation. Of 53

¹ *Annals of Surgery*, May, 1908.

² *Ibid.*, June, 1908.

³ *Journal of the American Medical Association*, 1908, No. 18.

⁴ *Zeitschr. f. Urologie*, Band ii, Nr. 6.

⁵ *Wiener med. Woch.*, 1907, Nr. 45.

⁶ *Wiener klin. Woch.*, 1907, Nr. 40.

cases of benign papillomata, recurrence was observed in 21 within eight years after operation. The longest periods of freedom were seventeen years in 1 case, fifteen years in 2 cases, fourteen years in 4, and twelve years in 8 cases. Recurrence is used in a clinical, not an anatomical, sense; for the second papilloma never grew on the same spot as did the first.

Of 49 papillomata with cancerous features, 29 recurred between six months and six years. In 3 which were operated on a second time, carcinoma had developed in the scar of the earlier operation.

Of the 95 carcinomatous cases, 42 were seen later and 20 others heard from; all had recurrence, most of them in less than two years; one of them seven years later.

Metastases from bladder cancer were observed in 7 cases—in the liver, lung, kidney, pleura, and axillary glands.

In 3 cases the removal of a benignant papilloma was followed by the growth of a carcinoma in the scar.

In the discussion by the German Urological Congress,¹ Lichtenstern mentioned 2 cases where the removal of a vesical papilloma, appearing under the microscope to be benign, was followed by the growth of a carcinoma in the scar. Casper had seen 7 such cases, and others present mentioned 3 additional instances. Loewenhardt, on the other hand, mentioned 3 cases in which a carcinoma had been destroyed by the cautery endovesically, without recurrence in several years. It would seem that the raw surfaces made by the knife afforded opportunity for the growth of particles of the original tumor implanted therein.

Brown² studied 10 cases of carcinoma of the bladder postmortem; in 7 metastases were found.

C. H. Mayo³ says that the large percentage of early recurrence following the removal of bladder tumors indicates delayed operation or imperfect removal. As the use of the cystoscope becomes more general, early operation becomes more frequent. Imperfect removal is due in part to imperfect exposure of the field of operation. Mayo makes a long median incision, opens the peritoneum, and walls off the intestines with large gauze pads. He then opens the bladder through its peritoneal covering, excises the tumor, and burns the diseased area with the Paquelin cautery. Large areas, even two-thirds, of the bladder are resected when necessary. He has operated on five vesical tumors, three of them malignant, in this way without mortality.

CYSTS OF THE BLADDER. Brongersma⁴ adds a case of vesical cyst to the five already described. Difficulty in urination in a woman, aged fifty-two years, led to a cystoscopic examination, which revealed a tumor

¹ Wiener med. Woch., 1907, Nr. 45.

² American Journal of the Medical Sciences, vol. cxxxiv.

³ Annals of Surgery, July, 1908.

⁴ Zeitschr. f. Urologie, Band ii, Nr. 6.

growing from the left side of the trigonum. Through a suprapubic incision he removed a cyst 3.5 cm. long and 2.75 cm. broad.

HERNIA OF THE BLADDER. Hansen¹ gives the details of seven cases of hernia involving the bladder. The patients were between the ages of forty-one and sixty-seven, and all but one were males. In only one case was the diagnosis made before the operation. If the cystocele is small, or if it is an operative cystocele, it will be found growing thicker upward and enveloped in fat. This thicker extension will be discovered to be the bladder, when the prevesical fat is detached. In case of doubt the bladder can be filled with fluid and the effect watched on the cystocele. If there is a diverticulum or a stone in the hernia the bladder must be opened and resected, otherwise the bladder is reduced unopened. In case of injury the bladder must be sutured, a permanent catheter inserted, and the herniotomy wound drained.

GASTRIC AND DUODENAL ULCERS FOLLOWING WOUNDS OF THE BLADDER. Roberts² discussed this subject before the American Surgical Association. He mentioned a death from perforating gastric ulcer after suprapubic lithotomy which he had reported in 1887, and a few years ago he lost another patient from hemorrhage due to ulcer of the duodenum occurring in a man who had suffered extraperitoneal rupture of the urinary bladder and other injuries. He referred to the probability of gastric and duodenal ulcerations being pathological sequences of the bladder lesion. Roberts collected from literature and his own experience 16 instances of gastro-intestinal bleedings subsequent to operative or other lesions of the urinary organs. The result was death in 14 cases; recovery in 2. Cystotomy was performed in 5; litholapaxy, 1; nephrotomy, 3; extravasation of urine, 2; nephrorrhaphy, 2. In cases not operated on ulceration occurred after pericycstic abscess in 1 case; perinephritic abscess, etc., 1; perineal abscess, etc., 1; making a total of 16. In 7 of the 10 fatal cases ulceration was found at autopsy. In several of the remaining cases no necropsy was made, and the question of the presence of ulcer of the stomach or intestines, therefore, remains undetermined. He mentioned the fact that Curling, in his classic paper, published sixty-four years ago, on duodenal ulcers secondary to burns, stated that he had seen similar ulcers in surgical conditions other than burns. From a study of the recent literature on the subject, Roberts believes that the connection between abdominal and pelvic operations and postoperative hematemesis and intestinal bleeding occurs often enough to suggest a pathological connection. He also mentions cases of such hemorrhage and ulceration occurring after operative procedures on regions distant from the abdomen and pelvis which apparently prove that the postoperative bleeding and ulceration of the gastro-intestinal tract are caused by some more general pathological

¹ Zeitschr. f. Urologie, Band ii, Nr. 6.

² Journal of the American Medical Association, May 30, 1908

influence than local interference with the abdominal and pelvic circulation alone. Although such lesions are probably more apt to occur after interference with the pelvic and abdominal organs, enough cases are on record to lead to the belief that a general condition, such as uremic intoxication, atheroma of the vessels, toxemia, and infection are instrumental in rendering the patient liable to the serious complication discussed. He emphasizes the serious prognosis in postoperative hematemesis or bloody stools, and made various suggestions as to treatment.

The Prostate. PROSTATECTOMY UNDER LOCAL ANESTHESIA. Lanz¹ emphasizes the dangers of any general anesthetic in the feeble old men who often require prostatectomy. In 11 cases he has made the trans-vesical operation under infiltration anesthesia with a 1 per cent. solution of cocaine and a few drops of adrenalin extract. The absence of pain was surprising, and the course of the patients to recovery gratifying. He considers this operation no more dangerous than the use of the catheter.

I have done this operation under cocaine infiltration repeatedly, although my patients have never failed to complain of pain.

ENURESIS AFTER PROSTATECTOMY. MacGowan² discusses this subject with 11 illustrative cases that have come under his observation. His conclusions are:

"1. That after removal of extremely large growths bladder control sometimes comes slowly, and a condition of enuresis, either partial or total, will exist for from six months to a year, and perhaps always. This condition, although lamentable, improves with time, and is apt to be best at night. There is no surgical remedy, if the operation has been complete. But I would recommend, wherever the leakage has lasted for six months, that careful rectal, urethroscopic, and cystoscopic examinations be made, and if any remaining intra-urethral or intravesical nodules be found that they be removed.

"2. There are some dense prostates, not malignant, which cannot be removed. Such cases should not be disturbed until the comfortable use of the catheter becomes impossible. Through these a permanent groove or furrow must be made, preferably by the cautery apparatus of Chetwood. They will always leak.

"3. When enuresis follows the imperfect removal of a small hard prostate, the only remedy is the hemisection of the fibrous ring and the prostate on its floor, and removal of the prostate, together with the non-resilient scar tissue. In such cases patients will then slowly regain control and be well people.

"4. If following a prostatectomy, usually perineal, and where the prostate has been only of moderate size, not belonging to one of the three preceding classes, there is enuresis, and a careful rectal examination

¹ Deut. med. Woch., May 21, 1908.

² Journal of the American Medical Association, February 15, 1908.

fails to show the presence of an intracapsular growth of palpable size, overlooked at the time of the operation, a careful examination of the posterior urethra¹ and bladder, with suitable optical instruments, has sometimes revealed the presence of small tumors of glandular tissue hanging or pressing into the vesical outlet, preventing its closure, and the removal of such tumors by *sectio alta* has resulted in a cure of the condition."

A NEW INCISION FOR PROSTATECTOMY. Wilms¹ has used, in 3 cases for the removal of the prostate, an incision that I have long used for securing access to the pelvic connective tissue. He makes the incision 4 to 5 cm. long, directly upon the descending ramus of the left pubic bone. After dividing the fascia, blunt dissection soon reaches the lateral lobe of the prostate. The ischiocavernosus muscle and the internal pudic artery are pushed toward the median line without being seen. The capsule of the left lobe is incised and the prostatic tissue enucleated; the right lobe is reached from its anterior surface, a sound being introduced. The prostatic urethra is removed, but the rectum cannot be injured. The bleeding is minimal.

RESULTS OF PROSTATECTOMY. Freyer² gives the results of 432 suprapubic prostatectomies. There were 29 deaths (6.7 per cent.), most of them due to the weaknesses of old age rather than directly to the operation. The remaining cases were entirely successful, which means that they enjoyed a normal urinary function without fistulæ, incontinence, or other drawbacks.

Young³ reports 238 cases of perineal prostatectomy with 7 deaths (2.9 per cent.) and but few fistulæ.

REGENERATION OF THE PROSTATE. Hedinger⁴ describes 2 cases of apparent regeneration of prostatic tissue. In August, 1905, he removed by perineal incision the entire hypertrophied prostate of an elderly patient; the clinical history and the microscopic picture of the tissue removed were those usual to prostatic hypertrophy. Four months later the patient died from strangulated hernia. Autopsy disclosed a large, typically hypertrophied prostate, 5 x 4½ x 2 cm. in dimensions. The microscope showed normal prostatic tissue, and positively no evidence of carcinoma. The second case was essentially similar.

Freudenberg, a year earlier, reported 3 cases in each of which an apparently normal prostate was found, although he had some months earlier removed the entire prostate through a suprapubic incision. He remarks incidentally that all three were potent.

The frequency of carcinoma of the prostate warrants the suspicion that the rapid reproduction of epithelial elements in these cases was a

¹ Deut. Zeitschr. f. Chir., June, 1908.

² British Medical Journal, October 5, 1907.

³ Journal of the American Medical Association, February 15, 1908.

⁴ Folia Urologica, 1908, Band ii, Nr. 1.

manifestation of cancer. Yet both of these experienced observers distinctly deny this possibility, one of them supported by the microscopic examination.

PROSTATIC HYPERTROPHY IN EUNUCHOID. Wheeler¹ describes two cases of faulty descent of the testicle. One was eighty years old, and had never had sexual life; both testicles were found at the internal inguinal rings; penis fairly developed; vesicles small; figure and mons veneris feminine; beard thick and long. In spite of his arrested sexual development he had well-marked prostatic hypertrophy and obstruction; bladder trabeculated and sacculated; ureters dilated and purulent. Death had occurred from the obstruction and ascending infection.

Bérard² made a suprapubic prostatectomy, removing a middle lobe and two lateral prolongations, one of which proved to be a seminal vesicle, incrustated in the bladder wall. The ureter was not injured.

PROSTATIC CALCULI. This subject was discussed at a meeting of the French Urological Congress.

Tédénat³ removed by lateral lithotomy an oxalate stone from the prostate of an eighteen-year-old patient, whose urinary symptoms had existed for thirteen years. Lacemur expressed the opinion that these calculi are often found during childhood; he had removed from a youth by prerectal incision a prostatic calculus weighing 110 grams; urinary symptoms had existed for twelve years.

PROSTATIC ABSCESS. The French Congress devoted a session to this subject.⁴ Considerable diversity of opinion was expressed as to the frequency and treatment of such abscesses, the difference being apparently due to the confusion of prostatic abscess with prostatic suppuration, which drains into the urethra. Hartman and Lavenant have seen only 33 cases of prostatic abscess among 11,000 patients in the Lariboisière, these being caused by gonorrhea or by septic catheters; 12 of these healed without operation; the remainder were opened through the perineum. Escat, Motz, and others, on the other hand, consider these abscesses frequent, especially among the elderly subjects of prostatic hypertrophy.

The choice of the incision for opening a prostatic abscess also elicited a difference of opinion; some insisted that the perineal is the only proper avenue of approach, while the majority favored incision wherever pointing is detected, whether perineum or rectum. The majority advised early intervention.

Lusk,⁵ in an illustrated article, advocates the drainage of prostatic abscesses through an incision into the ischiorectal fossa.

Vogel,⁶ from Posner's clinic, renews the proposal to remove the pros-

¹ American Journal of Urology, July, 1908.

² Revue de Chirurgie, 1908, No. 2.

³ Folia Urologica, 1908, Band ii, Nr. 5.

⁴ Ibid.

⁵ Annals of Surgery, vol. xlv, No. 1.

⁶ Berliner klin. Woch., 1908, Nr. 4.

tate through a perineal incision, when less radical treatment fails to arrest prostatic suppuration in the elderly subjects of prostatic hypertrophy; and Alexander would extend this practice to younger subjects. Loumeau has in two cases made a prostatectomy to relieve the pain after prostatic suppuration, and advises this measure. It would seem that the necessity for this treatment seldom exists.

Pelvic Abscess in the Male. McLaren¹ states that pelvic abscess in the male is practically always due to *appendicitis*, and should be evacuated into the rectum, as such abscesses in women are into the vagina. Only the groundless fear of infecting the rectum has prevented such practice. Many appendiceal abscesses open spontaneously into the rectum and heal promptly. He advises that in every case of appendiceal abscess examination by rectum should be made, and drainage into the bowel effected when feasible. He reports 5 cases treated in this way, with prompt healing in 3 cases, less rapid in 2.

Harte narrates a severe case of pelvic abscess and pain in left side, supposed to proceed from the prostate; an opening from the rectum evacuated a quart of pus; recovery promptly followed.

Khautz² saw a case of appendicitis with anuria; an abscess in Douglas' pouch was discovered and evacuated into the rectum. The urinary secretion was at once resumed. He suspects that the anuria was due to compression of the ureters by the abscess.

Pollard³ also advocates evacuation of pelvic abscesses in the male into the rectum; he has thus treated appendiceal abscesses without an abdominal opening. McArthur has opened fifteen pelvic abscesses in the male into the rectum in the past few years.

It is gratifying to one who has never hesitated to open a pelvic abscess or suppurating seminal vesicle into the rectum, to see this plan advocated by many others. Yet McLaren's statement that virtually all pelvic abscesses in the male proceed from the appendix, is certainly erroneous; and so is the advice to open them all from the rectum. Many point toward the perineum, through which the incision is naturally made.

INFECTION OF THE SPACE OF RETZIUS. Englisch⁴ discusses the pelvic fasciæ in the male, and the etiology of abscesses in the prevesical tissue. He still uses the term "idiopathic" for those whose source of infection is not apparent. Cases are multiplying which indicate that some, perhaps many, of these pelvic infections arise not by direct continuity with a mucous surface, but through lymph vessels and veins, which bring the infection from urethra, prostate, or rectum. The frequency of phleboliths in the pelvic veins suggests the possibility that these may be sometimes the site of the original infection.

¹ Annals of Surgery, June, 1908.

² Wiener klin. Woch., 1907, Nr. 50.

³ British Medical Journal, July 25, 1908.

⁴ Folia Urologica, Band i, Nrs. 3 und 4.

Ersing¹ discusses prevesical abscess in connection with an operated case where gonorrhea and tuberculosis were positively excluded. The prevesical infection seemed to have originated in injury to the anterior urethra by instrumentation, and to have been carried by lymphatics to the lymph glands in the space of Retzius. Swinburne² opened an acute prevesical abscess in a man who, three years before, had had gonorrhea, but in whom no connection between the two infections could be traced.

The Urethra. CARCINOMA. McMurtry³ has collected 27 cases of urethral carcinoma in women, including 2 personal cases. The diagnosis between carcinoma and caruncle or syphilitic lesions is difficult. When recognized early and the urethra completely excised the chance of permanent freedom is good; otherwise not.

Karski⁴ takes a more favorable view. He states that of 29 cases in which excision was performed only 2 are known to have recurred.

Englisch⁵ analyzes reports of 41 cases of urethral carcinoma in the male, including 3 of his own; the youngest patient was twenty-one years old, but most were over fifty. In most of the recorded cases the nature of the disease was not recognized until excision was too late to prevent recurrence.

DISASTERS FOLLOWING PASSAGE OF SOUNDS. Brennocke⁶ treated a sixty-five-year-old man, suffering from cystitis and chronic uremia. After some improvement in health the bladder was explored for stone with a sound. Complete anuria occurred immediately, and death thirty hours after the sounding.

Wyeth⁷ attempted to pass a filiform through a tight urethral stricture in a man aged forty-three years; death followed fifteen minutes after the attempt. The author ascribes the death to the trifling injury, though stating that he had injected into the urethra just before the instrumentation 4 c.c. of a 2 per cent. cocaine solution. The many deaths and collapses after such cocainization of the urethra have been so numerous that many genito-urinary surgeons have long since ceased to use this drug for urethral anesthesia.

Berg⁸ saw a pyogenic infection of one kidney, requiring nephrectomy, following sounding for stone.

The Testis and Seminal Duct. CANCER. Howard⁹ states that in twenty years there were observed among 110,000 male patients in the London Hospital, 57 cases of malignant disease of the testis verified by

¹ Annals of Surgery, August, 1908.

² Medical Record, August 1, 1908.

³ Journal of the American Medical Association, June 20, 1908.

⁴ Zeitschr. f. Geb. u. Gynäk., December 28, 1907.

⁵ Folia Urologica, Band i, Nr. 1.

⁶ Münchener med. Woch., 1907, Nr. 42.

⁷ Folia Urologica, Band i, Nr. 7.

⁸ Journal of the American Medical Association, February 29, 1908.

⁹ London Practitioner, December, 1907.

microscopic examination. Of these, 9 (16 per cent.) developed in undescended testes; 2 died of operation, and 1 disappeared; in 26 recurrence was observed; 8 remained free (24 per cent. of those traced).

THROMBOSIS OF THE SPERMATIC VEINS. The role of thrombosis and phlebitis in producing swellings within the scrotum has received but scant attention. Yet some of the inflammatory processes within the scrotum, called epididymitis, etc., are caused by infection of the veins from the urethra, rectum, or blood current. Thrombosis of the spermatic veins causes swelling and tenderness, which may sometimes require operative interference. Ransohoff¹ has operated on two such cases, in which thrombosis of the spermatic vein followed violence, and caused a tender, painful swelling in the course of the vein.

Phlebitis of the plexus of Santorini is not rare in elderly men, following infection of the prostate by catheter or otherwise; chill, fever, retention of urine, suppurative epididymitis or orchitis may follow.

Beardsley² reports 4 cases of *orchitis following typhoid fever*, in which phlebitis affecting the spermatic or pelvic veins seems to have been the anatomical origin. These cases began with chill, fever, and malaise; in 2 there was phlebitis of the saphenous vein of the same side, with some edema of the leg. Both testes and epididymis were swollen and painful, induration of the latter persisting for some weeks. Beardsley collects from the literature 102 cases, a brief analysis of which includes these features: The orchitis occurred during convalescence following typhoid fever in 71 instances, and during the fever in but 17, while no note of the time of occurrence was made in the remaining 14 cases. In 3 cases the complication was bilateral. There were 43 instances in which both the testicle and epididymis were involved; the testicle alone being involved 31 times and the epididymis alone 10 times; while in 18 the conditions were not differentiated. In a number of cases the cord was also involved. Suppuration occurred in 22 of the 102 cases and in many of these there was loss of testicular tissue and subsequent atrophy. It was noted that there was an effusion into the tunica vaginalis testis in 13 cases, and in 6 cases a urethral discharge was seen.

Kinnicutt and Gwyn (quoted by Beardsley) have called attention to the fact that a sudden acute pain in the abdomen may be due to thrombosis of the mesenteric veins, and in one of Kinnicutt's cases the infection of the epididymis evidently originated in the cord above Poupart's ligament, for the process could be traced downward to the testicle, the epididymis being affected forty-eight hours after the cord was palpable. In Gwyn's case there was sudden pain in the region of the appendix, and only later was the discovery of the enlarged testicle made. The implication of the cord suggests, as pointed out by Kinnicutt, an original infection either of the vas or of the spermatic veins, producing phlebitis

¹ *Annals of Surgery*, August, 1908.

² *Journal of the American Medical Association*, March 25, 1908.

with a thrombosis and secondary implication of the vas deferens by contiguity.

The infecting agent in these cases, when identified, has been usually the typhoid bacillus, but sometimes the ordinary pyogenic bacteria.

Mühlig¹ saw pulmonary infarcts follow immediately upon double epididymitis from acute gonorrhea, evidently from thrombosis of the spermatic veins.

TREATMENT OF EPIDIDYMITIS BY INCISION. This relatively new method has been practised by Dind and Métraux² in 51 cases of acute inflammation, with or without distinct abscess formation. In most cases pus was discovered; there was always prompt relief of pain, the fever fell, and the inflammatory induration rapidly disappeared. The cut is made on the posterior surface and does not open the tunica vaginalis.

For four years I have practised this incision in suitable cases,³ with great satisfaction.

RECURRENT EPIDIDYMITIS, though doubtless often due to repeated infections of the epididymis from the seminal vesicle by way of the vas deferens, may occur when the vas has been occluded by vasectomy. Bozy⁴ narrates two personal observations, in which, after prostatectomy—one suprapubic and one perineal—repeated attacks of epididymitis ensued, though in each case both vasa had been resected at the time of operation. He quotes a similar experience of Guillet, after vasectomy for prostatic hypertrophy.

In one such case I incised the epididymis on each side during the interval between attacks, which had occurred many times after a prostatectomy, and found an abscess in each epididymis. Apparently the infection was persistent in the epididymis after the first attack.

VESICULOTOMY FOR TUBERCULOSIS. Baudet⁵ collects 58 cases of this sort, including 7 of his own. Two died of the operation, 10 more of tuberculosis within a few months thereafter, and 46 were relieved of pain and improved in health. It is questionable whether any operation on the vesicle for the cure of tuberculosis is justifiable except for the removal of debris, as in the case reported by Brewer;⁶ here both vesicles, vasa, and testicles were removed from suppurating cavities.

Bacteriology of the Urinary Tract. Bond⁷ discusses the numerous cases in which bacterial infection of the urinary tract is apparently primary—*i. e.*, without stone, stricture, or other antecedent local cause. He criticises the current view that the urinary tract is infected by bacteria which are excreted from the blood by the kidneys, and expresses the

¹ Münchener med. Woch., 1907, Nr. 51. ² Guyon's Annales, 1908, No. 5.

³ Journal of the American Medical Association, April, 1905.

⁴ Presse médicale, November 2, 1907. ⁵ Ibid., October 26, 1907.

⁶ Journal of the American Medical Association, February 29, 1908.

⁷ British Medical Journal, December 7, 1907

opinion that these organs reach the bladder and renal pelvis by way of the urethra. He calls attention to these facts: (1) The majority of these infections are found in females, especially in women who are pregnant or suffering from gynecological affections; (2) Campbell has shown that bacterial infection of the urethra is common in gynecological cases, and others have noted that pyelitis is a frequent complication of pregnancy and that the ureters are dilated in late pregnancy—perhaps from the pressure of the uterus upon them at the pelvic brim. Bond showed, in 1905, that a regurgitant mucous stream does occur in the urinary tract, sufficient to carry particles of indigo from the anterior urethra to the renal pelvis, when the natural outflow is interfered with. He records three cases of his own in which a definite cystitis preceded the renal inflammation.

Putting all available data together, he thinks the conclusion irresistible, that the infection in these cases begins at the urethra and ascends to the renal pelvis.

Gurd¹ states that the divergent results of studies of the bacteria of the female genital tract by different observers is explained in part by the various methods employed. He regards the examination of smears from the discharges as of little value, and relies upon cultures from the vaginal discharge, especially in searching for the gonococcus. As a result of these observations, made largely at the Montreal General Hospital, he concludes that the gonococcus is even more frequently the cause of pelvic disease than is commonly assumed; and that at least 50 per cent. of the women attending the hospital gynecological clinics are suffering from gonococcus infection. Pregnancy and labor often arouse dormant gonococci into activity.

Hunner² relates four cases of pyelitis in women apparently due to appendicitis, the latter being overlooked because of the prominence of the urinary symptoms and findings.

Additional information on this subject is to be found in Davis' article in *PROGRESSIVE MEDICINE*, September, 1908, p. 150, and in the present volume.

BLASTOMYCETES IN THE FEMALE GENITALS. Van de Velde³ has found blastomycetes in pure or mixed cultures in the genitals of 77 gynecological patients, mostly cases of acute or chronic cervical inflammation. They are also common in the vulvovaginitis of little girls.

BACTERIAL INFECTIONS OF THE URINARY TRACT IN CHILDREN. These are discussed by Langstein,⁴ Abt,⁵ and Box.⁶ All are agreed in

¹ *Journal of Medical Research*, May, 1908.

² *Journal of the American Medical Association*, April 25, 1908.

³ *Centralbl. f. Gynäk.*, September 21, 1907.

⁴ *Therapeutische Monatshefte*, May, 1907.

⁵ *Journal of the American Medical Association*, December 14, 1907.

⁶ *Lancet*, January 11, 1908.

remarking the frequency of these infections and the ease with which they are overlooked. The symptoms are frequently fever and malaise, the urinary features often escaping attention because examination of the urine is omitted. These infections are especially common and commonly overlooked in little girls.

Systematic examination of the urine in the diseases of children reveals the cause and cure of many otherwise refractory ailments.

Sterility and Sterilization. Delbet and Chevassu¹ found 114 cases of *azoöspemia* among 131 patients with inflammation of the epididymes, acute or chronic. Probably half the cases that have double gonorrheal epididymitis are left permanently sterile. Their observations confirm the statement that the testicle continues its spermatogenic function behind the occlusion of the epididymes, and that fertility may be regained by a restoration of the canal. They have in six cases implanted the vas into the testicle, and in another instance united the vas with the epididymis (Martin's operation).

Pincus² deplotes the too frequent practice of treating women for sterility without examination as to the husband's fertility. He quotes Sanger's investigation of 110 sterile couples, which revealed *azoöspemia* or impotence in nearly 50 per cent., and only 15 per cent. more in which the sterility was apparently the result of gonorrheal infection of the wife.

Pincus has examined both husband and wife in 488 instances of sterile marriages. He found permanent *azoöspemia* in 62 husbands (12.5 per cent.); in 7.5 per cent. more the spermatozoa were few and feeble, and in 2.6 per cent. additional the spermatozoa were motionless. In nearly one-fourth of these 488 marriages, therefore (119 cases), the husband was sterile.

While the possibility of sterility in the subjects of bilateral gonorrheal epididymitis is generally recognized, I have been impressed with the number of sterile men personally observed in whom gonorrhea has invaded only one epididymis, or even neither of them. These cases comprise two classes: (1) Those in which both epididymal canals have been invaded by a mild infection proceeding from a deep urethral stricture, producing a chronic, painless induration of the epididymis, often with hydrocele; in these no spermatozoa are found in the semen; (2) cases in which the epididymes have never been infected and the semen contains abundant spermatozoa, which are, however, motionless. In some cases of this latter class, treatment of the chronically inflamed prostate and vesicles has been followed by a restoration of motility in the spermatozoa.

The uncertainties of the influence of *gonorrhea* upon fertility are well illustrated in two patients of mine who had sowed a large crop of wild oats together. One contracted gonorrhea six times, during which each

¹ *Revue de Chirurgie*, May 10, 1908.

² *Archiv f. Gynäk.*, July 13, 1907.

epididymis was twice invaded by the infection; yet his semen contained abundant motile spermatozoa, and soon after marriage his wife conceived. The other man escaped with two attacks of gonorrhea, which invaded the prostate and vesicles, but neither epididymis. After a year of sterile marriage, an examination of his semen showed plenty of spermatozoa motionless.

STERILIZATION OF THE UNFIT BY VASECTOMY.¹ The urgent necessity for restricting the irresponsible propagation of criminals and others who have been judicially declared parasites on society has been officially recognized by the State of Indiana.

In March, 1907, the Indiana Legislature passed a bill authorizing the sterilization of "confirmed criminals, idiots, imbeciles, and rapists" in the State institutions of Indiana. In the prison at Jeffersonville, over 300 convicts under thirty years of age have been sterilized by vasectomy, some by authority of the State, but over 200 of them *at their own request*. This voluntary submission to sterilization by hundreds of convicts removes the only conceivable opposition to this method of protecting society—namely, the sentimental.

Vasectomy is performed in a few minutes under cocaine anesthesia, through a skin-cut less than one-half inch long; it entails no wound infection, no confinement to bed; it is less serious than the extraction of a tooth. That obstruction of this tube does not impair sexuality is abundantly proved by the robust sexual health of thousands of men who have been unwittingly sterilized through bilateral epididymitis, and who never suspect their sterility until their marriages prove barren. That vasectomy itself is equally harmless to sexuality is shown by the experience of those upon whom it has been performed; among these, within my personal knowledge, are married men who took this means, rather than criminal abortion, to prevent the transmission to offspring of their own hereditary taints, such as insanity and syphilis. The sterility caused by vasectomy can be subsequently cured by a slight operation, which reunites the severed ends of the vas, should the subject ever desire to beget offspring. Irremediable sterility, such as is desired for the defective classes, is easily procured by removing a longer piece of the vas.

The reunion of the severed ends of the vas is easily accomplished by freshening these ends and passing a catgut or silkworm thread into the lumen of each end, out through the wall of the vas, and tying the thread ends. The thread thus serves as a splint, which keeps the ends in perfect apposition during healing. Of the many methods proposed, this one—first published by Mayo²—is distinctly the best.

¹ Belfield, Journal of the American Medical Association, January 4, 1908.

² Annals of Surgery, January, 1895.

PRACTICAL THERAPEUTIC REFERENDUM.

By H. R. M. LANDIS, M.D.

Antidiphtheritic Serum. During the past few years the greatest emphasis has been laid on the necessity of administering antitoxin as early as possible in diphtheria, and in all suspected cases not to wait for the bacteriological report. Statistics issued by the Chicago Board of Health (see PROGRESSIVE MEDICINE, December, 1902, p. 264) show that the death rate rapidly increases as the interval between the onset of the disease and the use of the antitoxin is lengthened. Figures issued in the last report of the Pennsylvania State Board of Health (1907) also brings out this fact very clearly, as the following table shows:

	Recov- eries.	Deaths.	Total.	Per cent. of deaths, 1907.	Per cent. of deaths, 1906.
First day	3304	159	3463	4.59	8.78
Second day	1039	100	1139	8.77	9.31
Third day	348	55	403	13.64	21.85
Fourth day	104	32	136	23.52	22.42
Fifth day	52	11	63	17.46	28.84
Sixth day	18	12	30	40.00	27.27
Seventh day	20	4	24	16.66	27.27
Eighth day and over	10	3	13	23.07	41.17
Totals	4895	376	5271	7.13	11.13

The distribution of free antitoxin throughout the rural districts of Pennsylvania was instituted by the State Board of Health about three years ago. The wisdom of this measure is amply justified by the results shown in the table. The cost per capita of providing the antitoxin has been reduced from \$5.16 in 1906 to \$3.55 in 1907. Several other States have since followed Pennsylvania's lead.

Baginsky¹ has published the results obtained in a series of cases (529) under his care in the Berlin epidemic of 1907. The mortality in his series was 11.9 per cent. The epidemic was quite severe, the larynx being involved in 110 instances. Taking into consideration the severity of the epidemic and the high percentage of laryngeal cases, the results are distinctly good when compared to the early days of antitoxin (15.6

¹ Berliner klin. Wochenschrift, July 6, 1908.

per cent.) and the pre-antitoxin days, when the mortality reached from 30 to 50 per cent. The fatalities in this series are attributed by Baginsky to the late use of the antitoxin and insufficient dosage. In a few cases death resulted from complications which the treatment could not be expected to influence or from tracheotomy accidents.

Baginsky is convinced, from his experience in this epidemic, that the antitoxin should be used early in amounts ranging from 1500 to 5000 units, the day of the disease, the severity and site of the lesions, the age of the child, and its physical development being the factors in determining the size of the dose to be employed in each case. Those of the largest experience in this country have repeatedly stated that the age of the child has no bearing on the dose (see *PROGRESSIVE MEDICINE*, December, 1906, and December, 1907).

Martin¹ has analyzed a series of cases to determine the cause of the mortality in diphtheria even when the antitoxin has been used. His conclusions are based on a series of 853 cases treated at the Hôpital Pasteur from 1900 to 1908. The mortality in this series was 9.73 per cent. The causes of failure are practically the same as those observed by Baginsky. Thus 28, or one-third, of the patients died within twenty-four hours of their admission to the hospital. These deaths, for the most part, represent cases in which there has been failure to inject the antitoxin promptly, and emphasizes, as Martin states, the necessity of using the antitoxin at once without waiting for a bacteriological diagnosis in the doubtful cases.

Other causes of death in children under two years of age were laryngeal complications requiring intubation, bronchopneumonia commonly resulting; and in older children and adults the occurrence of mixed infections. In a few instances death resulted from the late effects of the diphtheria toxin on the renal, hepatic, and suprarenal functions. In these cases the urine becomes scanty, with a large amount of albumin, or there may be gastro-intestinal disturbances and clay-colored stools. The suprarenal capsules show areas of cellular necrosis and hemorrhages. Martin states that the cure for this intense intoxication is the injection of large doses of serum.

The charge has been made that since the introduction of the serum treatment the instances of diphtheritic paralysis have been more numerous, and some have claimed that the paralysis is due to the ill effects of the serum.

Rosenau and Anderson² have made some experimental investigations on this subject. They first state that an analysis of the views of clinical statisticians does not show that the antitoxin treatment has any tendency to produce paralysis.

¹ Bulletin Médical, April 25, 1908.

² Hygienic Laboratory, United States Public Health and Marine Hospital Service, Bulletin 38, June, 1907.

They were able to produce in guinea-pigs by means of a partially neutralized mixture of diphtheria toxin and antidiphtheritic serum, so adjusted as to leave the toxon or paralysis-producing constituent of diphtheria toxin free to exert its specific action on the nervous system, paralysis, apparently identical with that seen in human beings. These experiments showed that the paralysis, after it has once appeared, is not influenced by the antitoxin, nor can its appearance be prevented if the antitoxin is injected shortly before the development of the paralysis. On the other hand, if the serum is injected twenty-four hours after the infection, the guinea-pig does not die and the paralysis is modified. Large doses given forty-eight hours after the infection do not modify the paralysis or save life. Repeated injections of antitoxin, beginning twenty-four to forty-eight hours after the infection, did seem to exert some favorable influence on the subsequent paralysis. A single injection of one unit twenty-four hours before or at the time of the infection was not followed by paralysis. Rosenau and Anderson state that better results should be obtained in man, as the poison is elaborated more slowly, and for this reason the antitoxin can be given with benefit at a much later period. This seems to be borne out by a recent experience of Middleton,¹ who obtained excellent results in a case of postdiphtheritic paralysis of some weeks' standing, with daily injections of antidiphtheritic serum.

Rosenau and Anderson emphasize the importance of early administration of the serum by pointing out that where one unit of antitoxin given early prevents paralysis and saves life, 4000 units totally fails when delayed forty-eight hours.

Krönig² states that the efficiency of the serum can be increased by incising the hard swollen tissues in the throat. This measure is particularly needed in those cases in which the fever does not subside after the injection of the antitoxin and the diphtheritic lesion in the throat remains hard and swollen. The incision generally bleeds very little; the more it bleeds the less marked is the capillary obstruction, and hence the danger of necrosis and gangrene is less. In order to promote the bleeding Krönig applies warm compresses outside and has the mouth rinsed out with warm water to which a mild antiseptic has been added. These local measures are followed by great relief and an immediate drop in the temperature.

In order to prevent this capillary obstruction Krönig urges the early use of antitoxin while the vascular passages in the region of the local process are open.

The distinctly favorable results which occur from the use of diphtheria antitoxin should be clearly kept in mind when reading the following pages on Anaphylaxis. The occasional occurrence of a serious untoward result after the injection of antitoxin should not weigh against the enormous saving of life which has resulted since its introduction.

¹ *Lancet*, July 18, 1908.

² *Therapie der Gegenwart*, July, 1908, No. 7.

ANAPHYLAXIS OR PROTEID HYPERSUSCEPTIBILITY. The past year has added a chapter to the subject of serum therapy which is of the greatest interest, but one that may lead to serious misapprehensions. The subject is one of such interest and importance that it may be well to devote to it considerable space.

The fact that guinea-pigs which had been used for testing the potency of antitoxins frequently died on receiving a second injection some weeks later had been generally known among laboratory workers for some time. No particular importance was attached to this fact, however, until about four years ago. During Ehrlich's visit to this country in 1904, Theobald Smith called his attention to this phenomenon, with the result that Otto was given the problem to solve. Otto's paper, which appeared in 1905, anticipated by a short time the work of Rosenau and Anderson, who were investigating the same subject. The work of these three investigators was independent and appeared almost simultaneously.

The phenomena which sometimes follow the injection of a foreign serum have been termed anaphylaxis, proteid hypersusceptibility, or supersensitiveness. This hypersusceptibility may show itself in one of two ways: (1) What may be termed the major effect, which manifests itself by symptoms of collapse and occasionally by death. (2) The minor effect, which has been termed serum disease. The fact that antitoxin injections were not infrequently followed by cutaneous rashes swollen glands, joint pains, and general malaise was appreciated long before the major effects of such injections excited attention. Since the publication of the monograph on "*Serumkrankheit*" by von Pirquet and Schick, in 1905, the relationship existing between injections of serum and the phenomena which sometimes follow have been better understood. At present the best studied instance of anaphylaxis is that produced in the guinea-pig by the injection of some foreign proteid, such as horse serum, egg white, milk, etc. The effect of horse serum has received special attention, owing to its extensive use in the production of curative sera. The best presentation of the subject is that contained in the "Review of Anaphylaxis, with Special Reference to Immunity," by Rosenau and Anderson.¹

Anaphylaxis is produced in the guinea-pig as follows: The animal is given subcutaneously from $\frac{1}{10}$ to $\frac{1}{250}$ c.c. of horse serum, and after an interval of from ten days to two weeks is re-injected with a larger amount, 1 to 3 c.c. Within a few minutes the animal shows signs of respiratory embarrassment, by scratching at the mouth, coughing, often of a spasmodic character, and rapid or irregular breathing. This stage is followed by paresis or complete paralysis, and later by convulsions or spasmodic, jerky movements. Death usually follows the convulsive stage. The later the anaphylactic symptoms develop the less likely is the animal to die.

¹ Journal of Infectious Diseases, January, 1908.

If the second dose is injected directly into the brain or circulation, the anaphylactic symptoms occur suddenly and with great violence, death ensuing in two or three minutes.

This condition of hypersusceptibility may be produced by exceedingly small quantities of serum, as infinitesimal an amount as $\frac{1}{1000000}$ c.c.; on the other hand, large quantities may be given at the initial dose without any ill effects following, unless a second dose is given after an interval of some days. This point is important to keep in mind in studying the untoward effects as seen in man; for in man anaphylactic symptoms develop occasionally after a single dose, and in the guinea-pig practically never. Both react to a second injection.

The exact nature of the substance causing these phenomena is not at present known. By some it is believed to be hemolytic; Rosenau is opposed to this view. Rosenau and Anderson are of the opinion that the reaction is the result of some profound chemical change in the central nervous system, rather than morphological reactions.

An animal once sensitized apparently remains in this condition all its life, and a second injection given at any future time, after the period of inoculation, will produce a reaction. Animals may be sensitized not only by subcutaneous injections, but by feeding them with some proteid material and after the usual interval injecting them. Furthermore, as shown by Rosenau and Anderson, the sensitizing principle is hereditary through the female. Thus, if a female guinea-pig is injected with horse serum before or during pregnancy, her offspring are born sensitized; that is, they will react to an initial dose of serum, which the normal guinea-pig practically never does. They point out that while several instances are on record where an immunity to an infectious disease is transmitted by the mother to her young, this is the first instance of hypersensitiveness being transmitted. They suggest that it may possibly throw some light on the fact that tuberculosis "runs in families."

Another interesting point in connection with maternal transmission is that related to the occurrence of anaphylactic symptoms in man. As already pointed out, anaphylaxis sometimes appears in man after the first dose. Possibly some of the instances seen in the human being are due to hereditary sensitization. In several of the cases recently recorded the individuals were subject to asthmatic attacks when subjected to the odors from horses. Naturally one of the first things attempted in studying this reaction was the endeavor to destroy this toxic principle, so that the serum would be absolutely free from ill effects. Rosenau and Anderson found that various preservative chemicals and ferments had no effect; neither was it affected by filtration, nor by the x -rays. Serum subjected to cold (15° F.) was unaffected, but when heated to 100° C. for twenty-five minutes the toxic property was entirely destroyed.

Besredka¹ states that all the usual phenomena of hypersusceptibility

¹ *Annales de l'Inst. Pasteur*, 1907, vol. xxi, p. 950.

in guinea-pigs may be prevented by ether narcosis. If the animal is injected intracerebrally as the muscles are undergoing relaxation from the effects of the ether no toxic effect appears, and after coming out of the ether the animal presents no untoward effect. Another injection of serum given the following day, without ether, is not followed by anaphylactic phenomena, showing that the animal has been immunized. Unfortunately, the phenomena as seen in man occur so suddenly that one has no time for such a procedure.

In a recent communication Besredka¹ advises the injection of all sera into the brains of guinea-pigs. Such tests have shown that different sera possess different powers of toxicity, the fatal dose ranging from $\frac{1}{4}$ c.c. to $\frac{1}{128}$ c.c. He states that a serum hypertoxic when fresh gradually loses its toxicity, but should be considered as toxic and unfit for use for two months. He believes that in general, every serum which causes grave anaphylactic phenomena in doses of $\frac{1}{16}$ to $\frac{1}{20}$ c.c. or less should be considered as toxic.

Another curious feature of anaphylaxis is the fact that each proteid has its own specific toxic property. Thus a guinea-pig sensitized for horse serum will not react when injected with milk or with egg white. Nor will a guinea-pig sensitized with egg white react to any of the other substances. Furthermore, Rosenau and Anderson have shown that a guinea-pig may be in a state of sensitization to two or three proteids at the same time and react to a second injection of each of them. These different proteids may be given at the same time, at intervals, at the same place or in different places, separately or mixed.

Immunity to this hypersusceptibility may be obtained in one of two ways: (1) By repeated injections of the serum during the period of incubation, that is, during the first ten days; or (2) by recovery from a second injection during the anaphylactic stage (Rosenau and Anderson). This relates to guinea-pigs and does not hold true for man, as will be seen later.

The *resume* given above relates to the phenomena as seen experimentally in animals. In man there are certain curious differences as yet but ill understood.

Of the cases so far reported as having occurred in man, diphtheria antitoxin has been the serum usually employed. I² have reported a series of seven cases with marked untoward symptoms following the use of Maragliano's antituberculous serum, and Waterhouse³ records a personal experience in which sensitization was produced by antistreptococcic serum. Eighteen months later he developed marked untoward symptoms following an injection of diphtheria antitoxin with a similar occurrence four years later after a second injection of diphtheria antitoxin.

¹ Revue Médico-Sociale, 1908, ii, p. 10.

² Paper read at International Congress of Tuberculosis, Washington, September 30, 1908; Therapeutic Gazette, November, 1908.

³ British Medical Journal, April 18, 1908.

An analysis of the symptoms as seen in man shows that the symptoms vary greatly in their intensity. As a rule, these major symptoms of anaphylaxis come on within a few minutes after the injection is given: in a less severe form the onset may be delayed for an hour or two. In the mildest form there is a feeling of faintness, substernal pain, some difficulty in breathing, paroxysmal cough, sneezing and itchiness, particularly of the scalp. There may also develop a distressing urticaria, or edema of the face may occur and swelling of the tongue. Nausea and vomiting is noted in some cases.

In a severer type the above symptoms, particularly those relating to the respiratory system, are intensified and the patient becomes cyanotic and shows signs of collapse. Frothing at the mouth may occur. In these cases there is a feeling of impending death. In the most severe form the symptoms are practically identical with those just enumerated, with the exception that paresis or paralysis and convulsive movements, as seen in the guinea-pig, develop and death rapidly ensues.

Wiley's¹ fatal case occurred in a strong robust man who had received 1000 units as a prophylactic measure. The untoward symptoms developed within two or three minutes after the injection was given, and in two or three minutes more the man was dead. In this case asthmatic symptoms always occurred when exposed to the odor from horses.

Schmitt,² who had moderately severe symptoms after a prophylactic dose of diphtheria antitoxin, states that he has always been subject to asthmatic symptoms when about horses. Boone³ had a similar experience. The antitoxin in this case was used for an attack of diphtheria. He has continued the use of the antitoxin since the accident, with uniformly good results.

In previous numbers of *PROGRESSIVE MEDICINE* mention has been made of the use of diphtheria antitoxin for a variety of conditions, among them asthma. Gillette⁴ records a fatal result occurring in an individual who was given 2000 units because of asthmatic attacks. He mentions two other cases in which a fatal result followed the use of antitoxin for asthma.

Cases in which collapse followed the use of antitoxin, but without a fatal result are reported by F. L. Taylor,⁵ Quigley,⁶ Dreyfoos,⁷ and Thomas.⁸ In the latter's case subsequent injections of the antitoxin were not followed by ill effects.

Comparing the anaphylactic phenomenon as seen in man with that in the guinea-pig, certain unexplainable differences are noted. In the first place a single initial dose, no matter how large, produces no reaction in

¹ Journal of the American Medical Association, January 11, 1908.

² Ibid., February 22, 1908.

⁴ Ibid., January 4, 1908.

⁶ Journal of the American Medical Association, March 7, 1907.

⁷ Ibid., September 5, 1908.

³ Ibid., February 8, 1908.

⁵ Medical Record, July 4, 1908.

⁸ Ibid., July 4, 1908.

the guinea-pig; while it may be followed with very marked untoward effects in man. Both, however, react to a second dose.

In the second place immunity to this reaction may be obtained in the guinea-pig in one of two ways: either by repeated injections during the period of incubation (first ten days) or by recovery from an attack of anaphylaxis. The variability of the reaction in man is illustrated in the series of 7 cases of hypersusceptibility following the use of Maragliano's antituberculous serum which I have reported. In 4 of the cases the evidence of hypersusceptibility occurred but once following the third, tenth, twentieth, and twenty-second injection. In 3 the injections were continued without further trouble. In 2 cases the evidences of hypersusceptibility occurred after two successive injections (third and fourth, tenth and eleventh). In one the injections were discontinued, and in the other they were continued without further trouble. The earliest case to react was on the sixth day after the third injection; the latest on the fiftieth day after the twenty-second injection. It will be seen that in these cases, contrary to what one finds in guinea-pigs, the evidences of hypersusceptibility were extremely variable in their appearance, developing as they did at irregular intervals after the treatment was instituted. Furthermore, the frequent injections received by these patients during the first ten days did not develop an immunity, nor did recovery from an attack of anaphylaxis prevent future attacks in two instances. All of these cases recovered.

In regard to the less serious evidences of hypersusceptibility—the “serum disease”—von Pirquet and Schick have shown that there is in man a normal period of incubation for the appearance of the serum disease, namely, eight to thirteen days. The first injection, however, renders the individual sensitive to future injections, so that if a second injection is given from fourteen days to four months after the first one the evidences of serum disease occur almost at once, or at least within twenty-four hours. This they term the “immediate reaction.” If the second injection is given after an interval of four months, the reaction, while delayed from five to eight days, occurs earlier than the normal interval following the first injection, *i. e.*, eight to thirteen days. This they term the “accelerated reaction.”

Blain¹ has reported 7 cases in which a second injection of diphtheria antitoxin was followed by a skin rash, 6 urticarial and 1 scarlatinal in character. The time of the occurrence of the untoward symptoms ranged from a few minutes to one week. Several of these cases presented symptoms of much greater severity than are usually encountered in “serum disease,” and should more properly be included among those suffering from the major effects of antitoxin, *i. e.*, those with symptoms referable to the respiratory tract associated with cyanosis and a weak pulse.

¹ Medical Record, June 6, 1908.

While the minor results of antitoxin or serum intolerance are usually of short duration, the ill effects may be very prolonged. In one of the cases reported by Blain the urticarial eruption persisted for months. Several years ago a member of my family developed symptoms of intolerance after a single dose of diphtheria antitoxin. In this instance the intolerance took the form of painfully swollen joints of the hands and feet, which lasted for three months. At the time it was ascribed to what was believed to be a streptococcic tonsillitis.

Six of the cases reported by Blain were blondes, 5 of them markedly so.

Royer¹ in a study of 30 cases illustrating the effects of second injections of diphtheria antitoxin comes to the following conclusions: There seems to be but little doubt in the minds of all who have worked in serum therapy that second injections of serum, after a considerable interval of time, cause immediate disturbance several days earlier than that met with as a normal reaction.

The "immediate reaction" is seen in from 18 to 27 per cent. of cases receiving injections. The "accelerated reaction" is probably seen in from 30 to 40 per cent. of such cases.

These reactions are annoying, but in no case yet reported have they resulted in death.

Spaced injections are errors in treatment, and should be avoided because of unnecessary sickening.

The experience and observations of others, combined with his own personal experience along purely clinical lines, leads him to believe that daily injections of serum for a period of several days in no way increase the disturbances which are commonly expected about the eighth or tenth day after treatment; that with a two-day interval in serum dosage rashes and febrile disturbances are more annoying; that if the intervals be three days, greater disturbances occur; and with four days or longer as an interval, graver disturbances may be anticipated.

As Royer states, the injections should be given at close intervals until the disease is under control, rather than allow several days to intervene between the injections.

The minor manifestations of serum intolerance have, of course, been appreciated for some years, and while they are in certain instances annoying to the patient, are scarcely to be considered.

The major manifestations, however, are serious and it is to be feared will lead to grave misapprehensions unless viewed in a calm and judicious manner.

Personally I do not believe that these serious untoward effects represent a new development in serum therapy. It is more than probable that they have existed from the beginning, and that the experimental work on the subject has been the means of drawing our attention to them.

¹ *Therapeutic Gazette*, June, 1908.

I know that my own experience and that of my colleagues with Maragliano's antituberculous serum was quite inexplicable at the time. All sorts of explanation were offered as to why they occurred, and in the end no particular attention was paid to them. It is quite likely that this has been the case with diphtheria antitoxin. Certainly until the past two years instances of any serious untoward effect following diphtheria antitoxin were of great rarity, at least so far as one is able to judge from the literature.

It must, I think, be admitted that a fatal result is most unusual, and the mere fact that it does occasionally occur should not alter our attitude toward the marvellous effect serum therapy has had on reducing the mortality of diphtheria and preventing its occurrence in those exposed to the disease. Nothing so far published should change our duty toward a patient suffering from diphtheria. Antitoxin should be administered, and in light of the recent work on untoward effects, should be given at frequent rather than at long intervals.

It must be admitted that at present symptoms of collapse and even death may follow an initial dose, but it must also be admitted that such occurrences are so extremely rare that in view of the gravity of the disease they may be disregarded.

As asthmatic patients seem to be particularly prone to these serious untoward effects antitoxin treatment for such cases had best be avoided. And this would probably be the wisest course to follow in any chronic condition not attended with the immediate danger of death.

Antimeningitic Serum. Meningitis has always ranked as one of the worst of the epidemic diseases; the mortality is always high, rarely falling below 40, and in some instances reaching 100 per cent. In addition to the high death rate many of those recovering have been permanently crippled.

As the result of a severe epidemic of cerebrospinal meningitis in New York City three years ago a commission was appointed to study this disease. This epidemic was one of the severest—numbering some 4000 cases—that has occurred in this country. The mortality was high—75 per cent.

The experimental work of the New York Commission was intrusted to Flexner. The results of his experiments, both in the production of the disease in monkeys and in the preparation of a serum, have appeared at different times and were referred to in *PROGRESSIVE MEDICINE* for last year (December, 1907, p, 269).

Reports on the use of antimeningitic serum are now appearing from widely separated points in this country and from Great Britain and Germany. In this country the serum has been furnished by Flexner, and in every instance the diagnosis has been confirmed bacteriologically. Of the more important papers which have appeared during the last year

may be mentioned those of Flexner and Jobling,¹ Dunn,² Chase and Hunt,³ Churchill,⁴ Miller and Barber,⁵ and Robb.⁶ Epidemic cerebrospinal meningitis was also the subject of a symposium at the last annual meeting of the American Pediatric Society.

Inasmuch as Flexner and Jobling's⁷ latest paper is an analysis of the results obtained up to that time (July 25, 1908), the figures here given are taken from that source. The number of cases subjected to tabulation is 393, which represents the total number after the moribund and fulminant cases have been subtracted. The total number of recoveries among these cases was 295 and the total number of deaths 98, giving a mortality of 25 per cent.

From the data at hand the mortality seems to be higher among patients over twenty years of age. This, Flexner and Jobling think, can be accounted for by the fact that a large number were treated by scattered physicians who had no experience with the serum. If this is not the reason, then it would appear that individuals over twenty years of age are less subject to the action of the serum than younger persons. They state that it is noticeable, however, that with one exception, wherever a series of patients of these ages were treated by a single observer the percentage of recoveries to deaths has been high.

The results obtained with Flexner's serum seem to bear the same relation to the time of the injection as does diphtheria antitoxin to diphtheria *i. e.*, the death rate increases in direct proportion to the length of the interval between the onset and the first injection. This is brought out by Flexner and Jobling in an analysis of 328 cases.

Period of injection of serum.	Cases.	Recovered.	Died.	Per cent. of deaths.
First to third day	121	103	18	14.9
Fourth to seventh day	100	78	22	22.0
Later than seventh day	107	68	39	36.4

They point out that the period embraced in the last group is highly irregular, since not a few patients came under treatment in a semi-chronic or chronic condition after many weeks of illness. Taking this into consideration, the outlook for cases of this type is not altogether discouraging. Flexner and Jobling are of the belief that so long as the diplococcus is still present in the meningeal exudate, and the mechanical damage to the tissues is not irreparable, the serum gives promise of achieving considerable benefit.

¹ Journal of Experimental Medicine, January 1, 1908; Journal of the American Medical Association, July 25, 1908.

² Boston Medical and Surgical Journal, March 19, 1908; Journal of the American Medical Association, July 4, 1908.

³ Archives of Internal Medicine, April, 1908.

⁴ Journal of the American Medical Association, July 4, 1908.

⁵ *Ibid.*, June 13, 1908.

⁶ British Medical Journal, February 15, 1908.

⁷ *Loc. cit.*

Antimeningitic serum is not an antitoxic serum, except to a very slight degree; it is bactericidal. The serum has a direct effect on the diplococci, causing rapid degeneration of the organisms and an arrest of free multiplication. In those cases in which the exudate is purulent in character recovery may take place, and in these cases the exudate clears up rapidly after the injection.

In addition to this marked local effect of the serum there is also manifested a striking change in the circulating blood. Before the serum injections are given there is a general leukocytosis. This general leukocytosis disappears very rapidly, often critically, with the disappearance of the diplococci and the clearing of the spinal exudate.

Dunn¹ states that there are three notable effects from the serum; First the fall in temperature; second, the rapid improvement in the patient's general condition, accompanied by a more or less marked relief of certain symptoms; and third, the course of the disease is shortened.

Flexner and Jobling have analyzed 270 cases to determine the manner of termination of the symptoms. Of these 270 cases, 201 terminated by lysis and 69 by crisis. They conclude that from 25 to 30 per cent. of cases treated with serum terminate abruptly.

The fact that the disease is shortened and the exciting factor is quickly destroyed would indicate that complications and sequels would be much less frequent in the serum treated cases. This Flexner and Jobling has found to be true. The only persistent defect noted was deafness; this occurred in a few instances only, and it was more often than not noted early in the disease before the serum injections were begun.

Sladen and Barker² emphasize the fact that the course of the disease is shortened and that the long-drawn-out chronic cases are not seen, and the terrible sequels, often worse than death, are rare in the serum-treated cases.

Technique of Administration. The serum is administered by injecting it directly into the spinal canal in order that it may be brought into direct contact with the diplococci. Another reason that led to this method is the fact that even in conditions of health the elimination of colloids, and even of crystalloids, into the spinal fluid is slow and uncertain. With the membranes diseased their elimination would be even more uncertain.

Churchill³ gives the following directions: A lumbar puncture is done and, if possible, 30 c.c. of fluid are withdrawn. Then to the cannula, still in place, is attached an ordinary antitoxin syringe, the serum poured from the bottle into the barrel of the syringe, and allowed to run directly into the spinal canal. As a rule, the piston must be used to force at least the last part of the serum. The serum should be heated to body temperature before using. This may be done by standing it in warm

¹ Loc. cit.

² Medical Record, June 20, 1908, p. 1055.

³ Loc. cit.

water. The amount at present recommended is 30 c.c., to be repeated every twenty-four to forty-eight hours for three or four times if there is no improvement. The dose may be increased to 40 or 45 c.c. (Dunn). It is directed that spinal fluid to the amount of the intended injection be withdrawn. Miller and Barber¹ injected a daily dose of 30 c.c., irrespective of the amount of spinal fluid obtained.

The reports from Germany on the use of an antimeningitic serum are no less encouraging than from the use of Flexner's serum. Többen² reports on 60 cases. The mortality in 37 cases treated by lumbar puncture alone was 56.7 per cent. In 12 cases in which the serum was administered on the first or second day the mortality was 16.6 per cent. Schöne³ reports a mortality of 57 per cent. in 36 cases not given serum and only 27 per cent. in 30 who received the serum. Levy⁴ had a mortality of 78 per cent. in 14 cases untreated and but 11.76 per cent. in 17 cases in which serum was injected into the spinal canal. These observers also testify to the relief the serum gives and the mildness of the complications if any arise.

The extremely gratifying results which have been obtained from the use of Flexner's serum would seem to warrant considerable enthusiasm. Flexner and Jobling,⁵ however, have taken pains to repeatedly state that they do not consider it evident and established that the serum has proved its usefulness as a therapeutic agent in epidemic meningitis. Their work from the very beginning has been characterized by the utmost conservatism. What they urge at present is as wide a use as possible of the serum with the proper clinical and bacteriological controls. They are willing to supply, at the Rockefeller Institute, a moderate amount of the serum for use under conditions which they will prescribe.

Antirabic Serum. The treatment of hydrophobia by means of the Pasteur method has been one of the therapeutic triumphs of recent years.

Pamponkis⁶ states that of 4524 patients given this treatment at the Athens Pasteur Institute, but eleven failures occurred. He calls attention to the fact that the treatment is apt to be unsuccessful if the body is later subjected to chilling or there is overindulgence in the use of alcohol. Five of the 11 cases of failure cited by him were attributed to these causes.

The necessity of going to an institution specially equipped for preparing the virus has been one of the drawbacks of this treatment. This has, to a great extent, been obviated by sending the virus, with directions as to its use, through the mail on receipt of full details as to the duration, location, etc., of the bite. This method of treating hydrophobia, or

¹ Loc. cit.

² Münch. med. Wochen., 1907, xlix, p. 2420.

³ Therapie der Gegenwart, 1907, xlviii, p. 52.

⁴ Deutsche med. Wochen., January 23, 1908.

⁵ Journal of Experimental Medicine, January 1, 1908.

⁶ Annales de l'Institute Pasteur, May 25, 1908.

rather of preventing the occurrence of hydrophobia, was given in PROGRESSIVE MEDICINE for December, 1906.

Semple¹ states that a serum of excellent potency may be obtained by immunizing horses with hydrophobia virus. Such a serum when mixed with the rabic virus does not produce hydrophobia in rabbits when inoculated subdurally. The serum may be used as an adjunct to the ordinary treatment in severely bitten and late cases.

Antistreptococcic Serum. Theoretically this serum should be capable of giving good results. Unfortunately, however, it has not come up to expectations. A few years ago antistreptococcic serum was quite generally used, but recently one hears less of it, particularly in those conditions one would expect to obtain good results, namely, puerperal sepsis, general streptococcic infection, etc. The most uniform results have been obtained in *ulcerative endocarditis*. And in view of the failure of other methods in this condition, antistreptococcic serum is probably the best treatment that can be given.

Davis,² while having no personal experience, mentions antistreptococcic serum in the treatment of *acute articular rheumatism*. Stengel³ believes this method has possibilities and in some cases of acute rheumatism offers the best form of treatment.

Cumpston⁴ reports favorable results from the use of the polyvalent serum in the severer forms of *scarlet fever*. Of 37 severe cases, 26 recovered and 11 died. In 4 of the cases 50 c.c. of the serum were given intravenously; this method seemed to give better results than the subcutaneous injections. To obtain the best results, Cumpston is of the opinion that the serum must be given in doses of not less than 50 c.c. and early in the disease—that is, when the rhinorrhea, swelling of the cervical glands, and increased fever occurs.

Yervant⁵ has used the serum in several cases of *otitic pyemia* with alleged good results.

Zangemeister⁶ believes that the sera at present on the market are useless. As the result of experimental researches on the subject, he is of the opinion that antistreptococcic serum is valueless unless obtained from some closely allied species. Thus he found that a serum obtained from horses or rabbits would protect mice and rabbits against all strains of streptococci, but was ineffectual in monkeys and man. Serum obtained from monkeys was ineffectual in rabbits and mice, but was protective in monkeys, and should, he believes, be successful in men who are closely allied to this species.

¹ Lancet, June 6, 1908.

² Journal of American Medical Association, December 21, 1907.

³ Ibid.

⁴ British Medical Journal, May 30, 1908.

⁵ La Riforma Medica, April 27, 1908.

⁶ Münch. med. Wochen., April 14, 1908.

Antitetanic Serum. The 1908 Fourth of July has gone; it was duly and characteristically celebrated, and has left in its wake a record of 5460 injuries, 108 deaths, and 104 blinded or half-blinded unfortunates. Appalling as this record is, our interest in the subject is chiefly concerned with the occurrence of tetanus and the effects of antitetanic serum. Owing to the crusade carried on by the *Journal of the American Medical Association*, the data relating to this phase of the Fourth of July celebrations are especially full and interesting. The following table shows at a glance the extraordinary decrease that has taken place in Fourth of July tetanus during the past six years.

CAUSES OF TETANUS CASES.

Year.	Blank cartridge.	Giant firecracker.	Cannon.	Firearm.	Powder, etc.	Total.
1903	363	17	5	3	27	415
1904	74	18	5	1	7	105
1905	65	17	4	5	13	104
1906	54	17	1	7	10	89
1907	52	8	6	4	3	73
1908	58	5	4	3	6	76

While the decrease from 1903 to 1907 was remarkable, the result this year shows no diminution, but an increase of 3 cases over last year.

This table also shows very plainly the most potent factors in the production of the tetanus, namely, the giant firecracker and blank cartridge. In another table the location of the wound is given, showing that of the 76 cases the hand or fingers were the site of injury in 56, which readily explains the danger of these agents. The wounds produced by the blank cartridge and giant firecracker are of the character to especially invite infection with tetanus bacilli, for, owing to the severe impact, dirt and foreign material are driven into the depths of the wound. If tetanus germs are carried in under these circumstances the conditions are favorable for their growth, as the serum and blood clot offers excellent culture media and the external closing of the wound furnishes the other requirement necessary for their growth.

These facts, and similar ones published during the past five years, should, one would think, effectually check the sale of the two most dangerous factors—the blank cartridge and giant firecracker. A few cities have prohibited the sale of firearms, and a few have made the effort to substitute other forms of celebration. In Philadelphia this year Fourth of July warnings in the public press took the form of pictures. The gruesomeness of some of the illustrations should have been ample warning. It is highly probable, however, that a considerable number of severe injuries and tetanus cases will occur every year until the causal factors are entirely removed.

In regard to the prophylactic use of serum for tetanus, the *Journal of the American Medical Association*¹ says: "We have made extensive

¹ September 5, 1908, p. 848; see also special article, p. 841.

inquiries into the treatment received by those injured in Fourth of July accidents, and have yet to learn of a single case in which tetanus developed in a person who had early received a prophylactic dose of antitoxin. The successful experience with the prophylactic use of antitoxin after this class of injuries, according to both current medical literature and personal communications, has led to its much more general application in cases of accidents from other causes, in which tetanus infection seems possible; and here, too, the results have been favorable."

In addition to the prophylactic treatment of these wounds with serum, local measures are most important. A patient with a Fourth of July injury or any punctured wound contaminated with street dirt should be anesthetized and the wound thoroughly curetted and given free drainage. Sedatives should be administered and the patient kept quiet. When the serum cannot be obtained the local treatment should be thorough, for such treatment of itself is often successful. This has been pointed out in previous years by the journal just quoted and more recently by Fricker.¹ So far as can be learned in this country, antitetanic serum has been universally successful as a prophylactic. There have been several reports from abroad, however, in which tetanus has developed after the prophylactic use of the serum. Last year Suter and Terrier and Mercade² reported 24 cases. An analysis of these cases showed that in some the interval between the time of infection and the time of injection of the antitoxin had been too long; in a few there was reason to believe that the antitoxin was inactive, and in a few, antitoxin powder had been used. In the majority of these cases the tetanus was mild in character, two-thirds of them recovering.

Vaillard³ has collected 31 cases, which probably include those just referred to. His explanation of the failures coincides with that just given. An additional factor, according to Vaillard, is that the serum protects against the toxin for only about a week, therefore in some cases spores which have not been removed later produce toxin sufficient to cause a mild tetanus. In one of his cases tetanus developed nearly thirteen weeks after a single injection.

In severe traumatic wounds Vaillard advises two or three times the ordinary dose. His practice is to inject from 20 to 50 c.c. for the initial dose, and then to give weekly injections of from 10 to 15 c.c. for some time.

In the light of our present knowledge everything points to the importance of treating wounds suspected of harboring the tetanus bacillus by means of antitetanic serum and energetic local measures. It should be borne in mind that the injection must be given at the earliest possible moment, for with the lengthening of the interval between the time of the

¹ *Deutsche Zeitschrift f. Chirurgie*, 1908, lxxxviii, Heft 4 to 6.

² *PROGRESSIVE MEDICINE*, December, 1907, p. 268.

³ *Bulletin de l'Académie de Médecine*, June 2, 1908.

infliction of the wound and the time of injection the liability to tetanus increases. Experimentally it has been shown by Donitz¹ that for a prophylactic injection in an animal the dose effectual after four minutes has to be six times as large after an interval of eight minutes, twelve times as large after fifteen minutes, and twenty-four times as large after an hour. These facts emphasize the importance of early administration of the serum.

In regard to the treatment of tetanus once developed, the editorial already quoted from states that: "Curative treatment still remains deplorably ineffective in Fourth of July tetanus, in which the infection seems to be of exceptional virulence, as shown by the short period of incubation, which averaged but seven days, and the rapid course of the symptoms, which terminated fatally in thirty-six hours on the average. Recovery rarely follows any form of treatment of tetanus when the incubation period is less than ten days, but becomes more and more frequent as the period of incubation lengthens, a fact that must be considered in estimating the value of any method of treatment."

Our helplessness in dealing with tetanus that has once developed, particularly the type with an incubation period of less than seven days, is illustrated in the following reports. Brandenstein² reports 24 cases of traumatic tetanus and 2 of local tetanus, with a mortality of 82.3 per cent. Serum was used in 20 cases, and of these, 4 recovered, while of 6 cases not receiving serum, all died. Buckenheimer³ reports 29 cases occurring in von Bergmann's clinic during the past twenty-five years. The mortality in their series was 86.2 per cent. Three of 20 cases receiving serum recovered.

Fricker⁴ reports 40 cases. Of these cases, 18 occurred before the advent of the antitoxic serum; 16 died and 2 recovered. Of 22 cases treated with serum and other measures, 10 recovered and 12 died. The second series, however, contained a greater number of mild or moderately severe cases, which Fricker believes should be taken into consideration before attributing too much to the serum. In addition, energetic local treatment (curettage, etc.) was employed in the second series.

The most important conclusion to be drawn from these reports is that when recovery occurs from tetanus it is almost always in the cases with a long incubation period and mild or moderately severe manifestation. Brandenstein states that all of his cases with an incubation period of less than eight days died, and Bockenheimer had the same experience.

In addition to the 76 cases of Fourth of July tetanus reported in the "Special Article" of the *Journal of the American Medical Association*,⁵

¹ Quoted by Brandenstein, *Deutsche Zeitschrift f. Chirurgie*, February, 1908.

² *Deutsche Zeitschrift f. Chirurgie*, February, 1908.

³ *Archiv f. klin. Chirurgie*, 1908, Nr. 2.

⁴ *Ibid.*, 1908, Nrs. 4 to 6.

⁵ September 5, 1908, p. 45.

there have been 166 cases reported during the last year in which tetanus followed penetrating wounds from nails or splinters, crushing injuries, or other causes.

The obvious lesson to be learned is to treat all wounds (whether Fourth of July injuries or not) with prophylactic injections of tetanus antitoxin in which there is a suspicion that tetanus may develop. Brandenstein¹ states that it is the rule in the hospital he is connected with in Berlin to give prophylactic injections in all cases of wounds soiled with garden or street dirt or horse manure, or made by splinters, bullets, or by freezing. In most cases the injuries were from being run over by vehicles. Since adopting this rule tetanus has never developed in any case receiving prophylactic injections. Additional details regarding the treatment of tetanus are included under the heading "Sulphate of Magnesium."

Antityphoid Serum. Chantemesse² again reports on the results obtained with his antityphoid serum. The report gives the results obtained in 1000 cases during the past six years. The mortality was 4.3 per cent. He compares these results with those obtained in other Paris hospitals in which 5621 cases were treated during a similar period, with a mortality of 17 per cent. Equally good results were obtained by Brunon, of Rouen, Josias, of Paris, and the military surgeons at the hospital of Val-de-Grâce.

The serum is obtained from horses which have been subjected for long periods to injections of typhoid toxins in the form of filtered and sterilized cultures grown on bouillon of beef spleen.

The serum is injected under the skin in the dose of from 1 to 5 drops. Following the injection there is a period of reaction in which the temperature may become higher. Improvement is not noted for some hours or even several days. After the period of reaction is over the blood pressure goes up, the urinary secretion is increased, the temperature gradually falls, and the patient feels more comfortable. Under the use of the serum the course of the disease is shortened and the minor complications not frequent. Of the 43 cases ending fatally, 4 died of hemorrhage and 19 from perforation.

In spite of these favorable reports of Chantemesse, his serum has received but little recognition. The general feeling is that as yet there is no specific treatment for typhoid fever. Vaughan,³ in a recent article on the subject of specific therapy in typhoid fever, states that enough has already been done to convince us that no antitoxin comparable to that which we have for diphtheria is likely to be found for typhoid fever.

Vaughan compares diphtheria and typhoid fever as follows: "In diphtheria the bacillus grows on a mucous surface, developing a chemical poison which is absorbed into the circulation and which induces the systemic symptoms of the disease and causes death. In typhoid fever

¹ Loc. cit.

² Medical Press and Circular, December 25, 1908.

³ American Journal of Medical Sciences, September, 1908.

the bacillus first finds its way into the interior of the body, and finally into the blood. One is, strictly speaking, apart from its local action, an intoxication; the other is a true systemic infection. In diphtheria the bacillus is the product of the poison; in typhoid fever the bacillus is the poison. The poison of diphtheria reaches the blood as a soluble, chemical body; the poison of typhoid fever reaches the blood as a living, multiplying cell. The poison of diphtheria is a soluble toxin; that of typhoid fever is an integral part of the bacterial cell, and if our definition of a toxin is a poison that may be used to generate an antibody to itself, the active agent in the typhoid bacillus is not a toxin, because there is not the slightest evidence that in any animal it elaborates an antibody."

Vaughan has prepared a residue from typhoid bacilli which he believes may be of service in preventing relapse, and in case we can find some method of early diagnosis it may prove of value in aborting the disease. The original article should be consulted for the details regarding the preparation of the residue and the experimental results following its use.

Atoxyl. This new arsenical compound was brought out about five years ago with the claim that it was possible by using it to introduce into the system large quantities of arsenic without toxic effects. Atoxyl was submitted to the Council on Pharmacy and Chemistry of the American Medical Association. As a result of their investigation, Puckner and Clark¹ state that atoxyl, instead of containing, as has been claimed for it, 37.69 per cent. arsenic, shows but 25.77 per cent. Comparing the amount of arsenic contained in the well-known Fowler's solution with atoxyl, they state that instead of the latter having forty times as much arsenic, it in reality has but one and one-half as much. Thus there is in each minim of Fowler's solution $\frac{1}{133}$ grains of arsenic while a corresponding dose of atoxyl contains from $\frac{1}{10}$ to $\frac{1}{24}$ grain.

The use of atoxyl in *syphilis* was suggested by the remarkably good results obtained with the drug in the *sleeping sickness*.

Koch² has had fairly satisfactory results with atoxyl in the treatment of the sleeping sickness. The best results are obtained in cases with a mild infection; in those more severely infected the results are not nearly so favorable, although even in these excellent results have been obtained. Koch states that while the drug cannot be viewed in the light of a specific for this disease, it is a most valuable aid in combating it. In the treatment of the sleeping sickness atoxyl should be administered systematically and for a prolonged period.

Present interest in atoxyl largely centres in its use in the treatment of syphilis. Salmon³ regards the drug as a third specific. Neisser⁴ also claims for atoxyl a specific action on syphilis. His experimental work

¹ Journal of American Medical Association, September 21, 1907.

² British Medical Journal, December 14, 1907.

³ Annales de l'Institut Pasteur, January, 1908.

⁴ Deutsche med. Wochenschrift, September 19, 1907.

with apes would seem to show that the drug has an extraordinary effect. Apes experimentally inoculated with the virus of syphilis showed no evidence of the disease if treated with atoxyl. Later, the animals could be reinfected.

On the other hand, Nobl¹ has published results showing that the atoxyl had no effect on the *Spirocheta pallida* when applied locally to the initial lesion or administered subcutaneously or intramuscularly after the secondaries had appeared. Many papers published on the *Spirocheta pallida* have shown that the spirochete is very difficult to demonstrate after the administration of mercury.

Untoward Effects. One of the early claims made for atoxyl was that it was non-toxic and could safely be administered in large doses. Now that the drug has had an extended trial, it is becoming apparent that it is a powerful agent capable of producing very serious untoward effects. The extent of its capacity for doing either good or harm is as yet unknown. Already several instances of serious eye lesions have been reported, and others in which marked toxic symptoms have developed. Salmon,² who is an enthusiastic advocate of the drug, does not believe the danger to the eyes is a real one. He quotes Koch³ to the effect that in treating the sleeping sickness ocular lesions never appeared except after large and repeated doses, such as would be neither indicated or useful in syphilis. Still, Salmon warns against using the drug in any case in which there are lesions of the retina or optic nerve, as the atoxyl may get the blame.

The toxic symptoms which may arise are colic, nausea and vomiting, headache, dyspnea, anxiety. They are not serious. Such symptoms may appear suddenly about ten hours after an injection has been given. They have been noted after a single injection, but most commonly occur after the fourth injection.

Dosage. Salmon advises that an interval of several days should elapse between each dose, in order to avoid a cumulative action. Furthermore, the drug should not be administered for too long a time, but intervals of rest given in order that complete elimination may take place. The dose, as recommended in syphilis, is from $\frac{1}{3}$ to 3 grains, the latter amount being cautiously approached. Salmon advises 50 cgms. (gr. $\frac{3}{4}$) as the necessary and efficient dose in syphilis, and that this amount should be given from the start without progressively increasing. In his opinion it is useless and even dangerous to exceed this amount. Inasmuch as patients cannot be habituated to the drug, it is useless to attempt to increase their tolerance by ascending dosage.

Atoxyl is a white powder slightly saline in taste and soluble in about one ounce of water. The solution should be slightly warmed before injecting.

¹ Wiener klin. Wochenschrift, October 31, 1907.

² Loc. cit.

³ Deutsche med. Wochenschrift, November 14, 1907.

In spite of some very encouraging reports, it does not seem that we are as yet warranted in looking upon atoxyl as a substitute for either mercury or the iodides. Its action is not certain and its untoward effects entirely too uncertain to make it safe at present. Unquestionably, however, the drug should be further experimented with, especially clinically, in order that its true place in the treatment of syphilis is established. While it may never supplant mercury, there is certainly a field for it in those cases of syphilis which are intolerant to that drug.

Balsam of Peru is very highly recommended by Suter¹ in the treatment of all recent open accidental *wounds*, such as compound fractures and extensive contused and lacerated wounds of the soft parts. Suter claims for Peruvian balsam the following advantages: (1) Its ability to mechanically enclose the bacteria so that they are incapable of doing any damage and are later killed. (2) A certain degree of bactericidal power. (3) The balsam has an extraordinary power of producing local leukocytosis. In addition to these advantages, Suter states that the balsam prevents putrefaction in the dead tissues.

He does not clean the fresh wound, not even to the extent of rinsing it with water or antiseptic solutions. Benzine is sometimes used to remove the dirt about the edges, and hanging tags of tissue not likely to retain their vitality are removed. The balsam is then poured or injected into the wound so that every crevice is filled. The dressing is not changed for several days unless the discharge is considerable. At the first and second changes the balsam is renewed.

Suter has now used this method in 562 cases of all kinds, some of them being very severe compound fractures. He states that the results were almost universally favorable.

The property possessed by balsam of Peru, of enclosing and rendering innocuous pathogenic bacteria renders it, according to Bockenheimer,² a valuable prophylactic against *tetanus*. Bockenheimer found experimentally that animals infected with tetanus under conditions approximating those in man, and then treated locally with balsam of Peru, either escaped the infection or had it in a mild form. In addition the animals so treated, if they developed the disease, did so at a much later period than the controls. Small amounts of antitoxin increased the efficiency of the treatment. This is quite possibly a valuable addition to our means of dealing with wounds likely to be followed by tetanus. It has been repeatedly emphasized in these reviews that the first thing to do in Fourth of July injuries is to thoroughly clean the wound by means of a sharp curette; and that this treatment is often efficient even if antitoxin is not at hand.

Why Suter omits thorough cleaning of the wound is difficult to under-

¹ Beiträge z. klin. Chirurgie, 1908, No. 1.

² Archiv f. klin. Chirurgie, 1908, No. 2.

stand. It can do no harm certainly, and would, one would think, greatly enhance the efficiency of the treatment.

In regard to kidney irritation, which it is known sometimes follows the use of balsam of Peru, Suter states he has never seen it occur. In these cases in which it has been reported as having occurred Suter believes an impure product was used. Borchard, while he agrees with Suter as to the efficiency of balsam of Peru in the treatment of open wounds, remarks that even after the use of small amounts albumin and casts sometimes appear in the urine. With the withdrawal of the drug all signs of kidney irritation disappear. In Borchard's cases these untoward effects seemed to be due to the balsam, and he therefore advises careful examination of the urine during its use.

Hoffman¹ has reported an instance in which acute nephritis developed after the local use of an ointment containing 10 per cent. Peruvian balsam for *scabies*. Suter² in his article states that almost without exception the instances of untoward action on the kidneys have been in individuals treated for *scabies*, a fact that should render its use in this condition very cautious.

Bicarbonate of Sodium is recommended by Haig³ in *bronchial inflammations* associated with very acid urine. He claims that the symptoms in these cases can be relieved by the use of an alkali in sufficient dosage to render the urine alkaline. Bicarbonate of sodium is the alkali of choice. The daily dose for a child is from 20 to 60 grains, and for an adult 90 to 120 grains. Drugs which tend to increase the acidity of the urine should not be combined with the alkali; this is particularly true of ammonium.

The use of bicarbonate of sodium in *diabetic coma* has been alluded to before. Elliott⁴ recommends for patients whose urine contains acetone at least half an ounce of bicarbonate of sodium daily. If coma is impending, from two to four times this amount should be used.

Boric Acid.⁵ The following is said to make a very efficient poultice: A tablespoonful of cold water starch is mixed with a teaspoonful of boric acid, and to this a little water is added. This mixture is added to a pint of boiling water and stirred until a uniform mucilaginous mass is formed. After the mixture has become cold it is spread on a piece of cotton and applied to the affected part. It is best to apply the poultice at bedtime and remove it in the morning. This form of poultice is recommended in acute and subacute *skin affections* prior to the application of salves.

Bornyval is a new nervous sedative, very highly spoken of by Ewald.⁶ Borneo-isovalerianate, or bornyval, a derivative of valerian, is a clear, aromatic fluid, with a faint odor and a taste of valerian and camphor.

¹ Journal American Medical Association, December 21, 1907.

² Loc. cit.

³ British Medical Journal, i, 1100.

⁴ Illinois Medical Journal, 1908, xii, p. 312.

⁵ Abst., Medical Record, March 21, 1908.

⁶ Folia Therapeutica, April, 1908.

The therapeutic action of bornyval is similar to that of valerian, and its indications are the same. Ewald has found it of service in neurotic conditions at the menopause; milder forms of neuralgia; in cardialgia; in vasomotor disturbances of the bloodvessels, due to unstable nervous equilibrium; in epigastric oppression; in precordial discomfort and allied neuropathies; in nervous dyspepsia and gastralgia; in mild nervous insomnia; in pruritus and dysmenorrhea. It has also been of service in enuresis.

The drug is dispensed in reddish tinted gelatin capsules, each containing 0.25 gram (miv). This method disguises the taste and smell. The capsules should not be taken on an empty stomach, but only after a full meal, and should be followed by a little milk, tea, or piece of bread. Unless this precaution is taken, a burning sensation often is complained of, and nauseous eructations may occur.

Bromides. While potassium bromide is the most commonly employed of the bromide salts, there are many who believe that it is the least preferable of all the bromide preparations, because of its tendency to produce undesirable by-effects. Of recent years the sodium salt has been more extensively employed and with many has entirely supplanted the bromide of potassium.

W. J. Robinson¹ reports on the use of *strontium bromide* in about 200 cases. He states that as a sedative it is quite as reliable as the potassium bromide, and that in addition it does not upset the stomach nor cause cramps, colic, or diarrhea. It is not a kidney irritant, but, on the contrary, will reduce kidney irritation. Strontium bromide rarely causes acne, and in the few instances in which it does the eruption is slight and of short duration.

In a number of Robinson's cases the digestion seemed to be improved under the use of the drug. Sée, who was one of those who originally advocated this preparation of bromide, found it useful in overcoming attacks of *gastric indigestion* associated with pain in the stomach and hyperacidity.

One of the prime requirements in using this drug is that it shall be chemically pure. Robinson states that whenever a patient complains of gastric irritation and nausea when taking the bromide of strontium, it is because the drug is contaminated with barium. The following test will reveal the presence of barium: Fifteen grains each of strontium bromide and of sodium acetate are dissolved in 75 minims of distilled water; about 5 to 8 drops of diluted acetic acid are added, and then 5 drops of potassium bichromate test solution. A cloudiness or precipitate indicates the presence of barium, and such a salt should be rejected.

¹ Journal of the American Medical Association, January 18, 1908.

The following formulas may be used:

R—Strontii bromidi	3j
Essentiæ pepsinæ	3j
Aquæ menthæ piperitæ (vel amygdalæ amaræ)	ad 3vj

M. et sig.—One teaspoonful, as directed.

R—Strontii bromidi	3j
Tr. cardamomi comp.	3
Aquæ	ad f 3vj

M. et sig.—One teaspoonful, as directed.

The dose of strontium bromide ranges from 10 to 60 grains three or four times daily.

Among the advantages claimed by Robinson for the drug are: that it is a positive anaphrodisiac; it is a positive nervous and genito-urinary sedative; it does not upset the stomach; it does not produce acne, or if it does produce a few acne pustules, they are mild and transient; often acts as a mild intestinal antiseptic; it does not irritate the kidneys—rather the contrary; and it has a tendency to diminish the quantity of albumin in albuminuria and sugar in glycosuria.

Spratling,¹ who has done much to discourage the indiscriminate use of the bromides in the treatment of *epilepsy*, contends that they have done nothing toward curing the disease. If they are used at all, 15 to 20 grains daily are as efficient, in Spratling's opinion, as the larger doses. He advises 5-grain doses three times daily, with proper stimulation of the eliminative organs.

The *nephritis* which often occurs in *pneumonia* needs little treatment, according to Fussell.² He recommends the following prescription:

R—Potassii bromidi,	
Potassii citratis	āā 3ij
Succus limonis	f 3ss
Syrupi	q. s. f 3iij

M. et sig.—f 3ij in water every two or three hours.

He states that the urine clears up, the fever decreases, and the patient feels more comfortable under its use. Laxatives should also be given.

Cactus Grandiflorus. That this drug and certain preparations derived from it and sold under the name of cactin and cactina are absolutely inert and without any physiological action has been shown by the work of Sayre, Houghton, and Hatcher.³ Matthews⁴ has repeated Hatcher's experiments. His condemnation of cactin and cactina is as positive as

¹ Albany Medical Annals, 1908, xxix, 172.

² Therapeutic Gazette, March, 1908.

³ PROGRESSIVE MEDICINE, December, 1907, p. 273.

⁴ Journal of the American Medical Association, March 21, 1908.

that of all who have tried to find any good in these preparations. His experiments on animals and himself showed that cactin was absolutely inert in doses at least a thousand times greater than that recommended, and that the cactina in large doses (two or three hundred times the dose recommended) depressed the circulation and respiration. In the dose recommended, cactina produced no action whatever.

Calcium Salts. During the past ten years the parathyroid glands have excited a great deal of interest.

It is now a well-established fact that these small glands play a very important part in the human economy, and that great care must be exercised not to disturb them when removing the thyroid gland. If all the parathyroids are removed, there results a condition known as *tetany*, characterized by muscular twitching and rigidity, tachypnea, fibrillary tremors, and increased action of the heart. Death frequently occurs.

Another fact that has been brought out is that there is an intimate relationship between the parathyroids and *calcium metabolism*. Thus it has been shown that animals fed on calcium-rich milk do not develop tetany so readily as those otherwise fed. Because of this withdrawal of the calcium salts, women at times show signs of tetany during lactation. Parathyroidectomized animals show an increased output of calcium in their excreta and a diminished amount in their blood. In certain diseased conditions, notably osteomalacia and rickets, where it is apparent that there is a disturbance in the calcium metabolism, tetany at times occurs.

MacCallum¹ expresses the view that the disturbance in calcium metabolism is analogous to that seen in diabetes mellitus, where the destruction of the islands of Langerhans interferes with the control of the carbohydrate metabolism, and much carbohydrate is abnormally lost.

Because of the apparent association between the parathyroids and calcium metabolism, and as the result of experimental work on the subject, W. G. MacCallum and Voegtlin² have published some interesting observations. These observers found that tetany could be prevented in a parathyroidectomized dog by the intravenous injection of a 5 per cent. solution of the *lactate* or *acetate of calcium*. The amount of the calcium salt injected was about one-half gram (gr. $7\frac{1}{2}$). They state that even in an animal showing signs of tetany the result of the calcium injection is miraculous, for sometimes immediately, sometimes in a few minutes, every symptom disappears and the animal returns to a state of perfect well-being. The effect of the injection lasts for a day or so and must again be repeated. So long as the calcium deficiency is thus supplied the animal shows no evidence of tetany. Given subcutaneously

¹ Proceedings of the Pathological Society of Philadelphia, 1908, Nos. 4 to 5.

² Johns Hopkins Hospital Bulletin, March, 1908.

or by mouth, the same effect is noted, but it is much slower in manifesting itself.

The operative removal of one-half or two-thirds of the parathyroids is apt to be followed by signs of tetany until the remaining gland or glands can take on the additional work thrown on them. During the past winter I saw a woman who had had a thyroidectomy done some years before, develop tetany during lactation. In this case the tetany doubtless occurred owing to the withdrawal of calcium salts in the milk. Similar cases are now on record in which the use of lactate of calcium controlled the tetanic symptoms.

Boggs¹ highly recommends *lactate of calcium* in conditions where increased coagulability of the blood is desired. I have used the lactate of calcium in 5-grain doses three times daily in cases with small recurrent *pulmonary hemorrhages*. It has been most satisfactory.

Boggs also recommends the lactate for *urticaria*. This use of the drug is purely empirical, and he is unable to explain why it does good.

Ross² highly recommends the *chloride of calcium* for *chilblains* (10 grains three times daily in a tumblerful of water); for *epistaxis* (15 grains thrice); and *menorrhagia* and *erythema nodosum* (15 grains thrice daily).

Döderick³ reports four cases of *blackwater fever* treated by calcium chloride. While his experience was not very encouraging, two of the cases dying, he believes the drug is worthy of a more extended trial.

The *iodide of calcium* has been of great value in the treatment of *leg ulcers* (3 grains thrice daily), and in the tertiary manifestations of *syphilis*. Ross states that if nausea occurs, the drug should be diluted more thoroughly.

Convallaria is little used at the present time, but is an important drug to keep in mind when digitalis fails. It has been especially recommended in cases of *arrhythmia* and "cardiac hurry."

Lenneker⁴ believes that convallaria is not only as efficient a heart tonic as digitalis, but that it, in addition, possesses the advantage of being free from some of the disagreeable effects of the latter. According to Lenneker, convallaria has no cumulative action, and instead of disordering the stomach, is a distinct tonic to that organ. Under its use the appetite increases, and, what is more, it exerts a tonic effect on the intestinal mucosa, increasing the action of the bowels in a great many people.

Convallaria is usually employed in the form of the fluid extract, in doses of from 2 to 8 minims. Lenneker has at times combined the convallaria with the fluid extract of *nux vomica*.

¹ Paper read before Section on Medicine, College of Physicians, Philadelphia, 1908; Johns Hopkins Medical Bulletin, July, 1908.

² Medical Press and Circular, September, 1907.

³ Therapeutic Gazette, 1908, p. 86.

⁴ Ibid., September 15, 1907.

Creosote is a drug about which phthisiotherapeutists are not in agreement. Some look upon it as being responsible for more harm than good, while others accord it a high place in the management of *tuberculosis*. Administered properly and to suitably selected cases, it is unquestionably a most valuable remedy; probably the one drug which can be given over long intervals of time with distinct benefit.

Philip¹ believes the drug most efficient in tuberculosis. In determining the treatment to be employed in a given case, Philip advises as follows: Ascertain as nearly as possible the amount of damage present, both local and constitutional. This should include also an estimation of the functional activity of every organ. After placing the patient under the best conditions as to open air, diet, rest, exercise, clothing, bathing, etc., Philip believes that one of two additional measures should be instituted—either the administration of tuberculin or, if this is not feasible, the exhibition of creosote or one of its congeners, for a prolonged period of time.

As Philip states, creosote to be of any benefit must be used in large doses and must be given for a long time. It is best to start with 1 to 3 minims and increase the dose 1 minim daily until at least 15 to 20 minims are taken three times daily. He administers the drug in capsules, in wine or in an emulsion of cod-liver oil. By far the most satisfactory method of administering the drug is in hot water. The details of this method of administration were given in *PROGRESSIVE MEDICINE* for last year (December, 1907, page 281). Another important point mentioned by Philip is that the treatment should be interrupted from time to time. The creosote or one of its derivatives should be given for four or five weeks and then omitted for a week or ten days. In place of the creosote, *guaiacol* may be used. The following formulas are recommended by Philip:

R—Guaiacol	1 part.
Alcohol (90 per cent.)	20 parts.
Aquæ	180 parts.

M. et sig.—One to three teaspoonfuls twice or thrice daily.

R—Guaiacol	℥iv
Alcohol (90 per cent.)	℥xl
Glycerin	℥xxx
Ol. cinnam.	℥j
Aquæ	q. s. ad f℥j
(One dose.)	

GUAIACOL CARBONATE is most efficient and less objectionable to take than either the creosote or guaiacol. The great drawback to the use of this drug is the cost. For patients who can afford it, I have found it the most satisfactory of these preparations. Guaiacol carbonate is given

¹ *Folia Therapeutica*, October, 1907.

in 5-grain doses three times daily. Larger doses have been advised by Jacobi, but they tend to disorder the digestion. Philip administers the drug in capsules in combination with arsenic trioxide. A formula which I have used for several years is that recommended by Jacobi:

R.—Guaiacol carbonatis	5 gr.
Arsenici trioxidi	
Strychninae nitratis	ãã $\frac{1}{4}$ gr.
Sparteïn. sulph.	1 gr.
M. et ft. in capsul. No. i.	
Sig.—One such capsule t. i. d. after food.	

It is not to be understood that all cases of tuberculosis should be given creosote or one of its derivatives. Incipient cases, or others with slight cough and expectoration, do not need such treatment. The great field for this treatment is in those with cough and profuse expectoration—that is, the moderately advanced and advanced cases with mixed infections.

In this connection attention may be called to methods of controlling a cough without resorting to medicine. Much is written on the subject of *cough*, and many drugs are recommended for its control. The vast majority of quack remedies recommended to consumptives have as their chief feature the relief they will give to the cough. It is not sufficiently appreciated that, so far as tuberculosis is concerned, a certain amount of coughing may be needed to remove the secretions. Paroxysmal, unproductive coughing, however, is harmful and unnecessary, and patients should be educated how to control it. It is astonishing how little coughing is done by some patients, even with extensive disease and profuse expectoration.

Richer¹ has called attention to these facts, and recommends the following directions to be given patients:

Fix the mind upon some pleasant thought. Take a deep breath very slowly, holding the breath for five to ten seconds; take a moderately deep breath, exhale slowly, with a partial attempt at forced expiration; try a forced expiration alone; take a few sips of water or milk, preferably hot.

The morning cough is much helped by taking a cupful of hot water upon waking. Avoid unnecessary talking; avoid hearty and sustained laughing; avoid dusty and smoky rooms, and don't smoke yourself.

Perseverance in these directions will help many coughs, but not all.

Some advocate in the beginning small doses of codeine, the drug being gradually withdrawn as the patient learns how to check the cough.

Ulceration or inflammatory conditions in the upper air passages produce a cough which requires local treatment.

¹ Journal of the Outdoor Life, January, 1908.

Woodbury¹ has for several years past treated *tuberculous osteitis* with *creosote* and *iodine*. The sinuses should be freely opened and irrigated daily with Lugol's solution in normal salt solution (3 per cent.). This is followed by injecting into the sinuses a mixture of creosote and cotton-seed oil (1 to 200). This strength of creosote is injected at first daily for a week. Then the strength of the creosote emulsion is increased gradually and the interval between the infections lengthened until an emulsion 1 to 60 is injected once a week. Internally he administers 10 drops of the compound tincture of iodine well diluted, three times daily.

Digitalis. The "Use and Abuse of Digitalis" is the subject of an excellent paper by T. C. Janeway.² While some of the points emphasized by Janeway were considered in the review for last year (PROGRESSIVE MEDICINE, December, 1907, page 289), the subject is so important that they will bear repetition.

1. *The Use of Inefficient Preparations.* It goes without saying that a drug upon which so much depends must be reliable. Janeway gives the requirements necessary for an efficient sample. As was pointed out last year, there is unfortunately at present no means of accurately standardizing digitalis preparations. For this reason we have to depend on the honesty of the manufacturer and druggist. Preparations made from the English digitalis leaves are the only ones to be employed. The great difference in cost between the English leaves and others is one very potent cause of inefficiency.

2. *The Use of Digitalis in Unsuitable Cases.* Janeway points out that the great field for digitalis is in those conditions which lead to general venous stasis, the result of inefficiency on the part of the ventricles. Failure is sure to result if digitalis is employed to slow the heart in a paroxysm of tachycardia, in fever, to promote diuresis in acute nephritis, or to remove an inflammatory pleural effusion. The only cases of rapid heart action in which digitalis is of service are those depending on insufficiency of the ventricles. The most important point brought out is that we should free our minds concerning the anatomical lesions affecting the valves. Digitalis cannot alter damage to the valves. It has to do with the ventricles only; so long as the ventricles accomplish their work, digitalis has no place in the therapy of valvular lesions. This point has been repeatedly emphasized, and yet digitalis is constantly being prescribed, simply because of a defective valve. It must always be borne in mind that while a heart with a defective valve is not normal anatomically, it is functionally normal so long as it performs its work.

In regard to the use of digitalis in aortic regurgitation, Janeway agrees with those who would use the drug when muscular insufficiency

¹Therapeutic Gazette, January, 1908, p. 76.

²American Journal of the Medical Sciences, June, 1908.

results. If there is loss of muscle tone, a diminishing systolic output, with scanty urine, a congested liver, and dropsy, give digitalis. Not uncommonly when these phenomena occur, in cases of aortic regurgitation, there is a relative mitral insufficiency, due to dilatation. Under these circumstances the problem differs in no way from that of ordinary mitral insufficiency. On the other hand, when orthopnea, or paroxysmal dyspnea, or anginoid pain occurs with aortic regurgitation, digitalis has no place in the treatment.

3. *Improper Dosage.* There is no aspect of digitalis therapy subject to such a variety of opinion as that of dosage. Some advocate large doses at long intervals; others, small doses at frequent intervals. Janeway believes that no routine method is advisable, but that the drug should be employed in each case according to the individual needs, always keeping in mind the toxic effects.

4. *Improper Methods of Administration.* In many cases of failing compensation there is great gastric irritability, due to venous stasis. Janeway points out the futility of administering digitalis by mouth when the frequent vomiting precludes the hope of the drug being retained. In such cases he advises subcutaneous injections, or, more preferably, its administration per rectum in the form of the infusion in the dose of half an ounce three times daily.

5. *Neglect of Other Therapeutic Measures.* Under this heading he advises a dry diet, free purgation, and, if anemia is present, the use of iron. For the insomnia and restlessness so frequently present Janeway advises the use of morphine. When insufficiency of the heart muscle is associated with arterial hypertension, the digitalis should be combined with one of the vasodilators.

Eserine (Physostigmine). This drug is largely used in ophthalmic practice; it has, in addition, been used with some success in the treatment of intestinal atony. It has been claimed by some surgeons that in eserine we possess a most valuable means of preventing postoperative meteorism.

Vogel¹ has found that the subcutaneous injection of eserine is most efficacious in relieving patients of the distressing meteorism that so commonly attends abdominal operations. He also advises its use in those who have suffered general contusions, with more or less injury to the bones, kidneys, and nervous system. Such cases are frequently sufferers from intestinal atony. In performing operations on patients for the second time, Vogel has noticed that the previous use of eserine prevented the formation of adhesions.

Vogel administers the drug in doses of from $\frac{1}{65}$ to $\frac{1}{200}$ of a grain. If a single dose does not give relief, it may be repeated in two or three hours. The peristaltic action of the drug may be increased by giving a small enema of glycerin, which of itself affects only the lower bowel.

¹ Mitteilungen a. d. Grenzgebieten, 1908, xvi.

Craig¹ has employed eserine for the past six years in postoperative cases of obstruction due to paresis of the bowel. Strobell² reports a case of intestinal obstruction due to paresis in which the subcutaneous injection of $\frac{1}{50}$ grain of salicylate of eserine acted most happily.

Physostigmine is usually employed in the form of one of its salts, the salicylate or the sulphate. The sulphate of eserine, being much more soluble, is the one usually employed. The dose is from $\frac{1}{100}$ to $\frac{1}{80}$ grain.

Exercise and Rest. The great benefit that may accrue from the use of properly regulated exercise is becoming better appreciated. And what is equally important is the fact that there are many conditions in which rest is the essential factor. In an editorial, H. A. Hare³ has pointed out that rest is most important after recovery from acute infections. As bacteriological methods become more and more perfected, it is becoming apparent that many of the infections, once thought to be purely local, are in reality general systemic diseases, and that all the organs of the body suffer, although some are more badly damaged than others. For this reason it is essential that a general survey be made of each organ when dealing with acute infections.

The author of this editorial calls attention to the frequency with which patients who have had acute articular rheumatism are allowed to get up after the disappearance of the local manifestations. As is well known, involvement of the endocardium is not uncommon in these cases, and while immediate ill effects may not occur, many of the instances of cardiac disability which later manifest themselves can doubtless be traced to lack of care during the period following convalescence. S. Solis Cohen⁴ also emphasizes this point. He states that the measure of supreme importance in the treatment of rheumatism is rest; rest strict enough and long enough for every patient.

We are also reminded in the editorial article just quoted that certain of the other infections, such as typhoid fever, pneumonia, and influenza, are capable of producing serious cardiac lesions. While rheumatism generally affects the endocardium, particularly the valves, the diseases just mentioned show their ill effects on the muscle, often producing degenerative changes or great feebleness. It can easily be seen that a heart so affected may be permanently crippled if it is too early subjected to undue strain.

In diphtheria, for instance, it is now pretty generally appreciated that complete rest in bed is imperative. Acute degenerative changes in the heart muscle are common in diphtheria, and even the exertion of suddenly sitting up in bed has been known to be fatal.

¹ Journal of the American Medical Association, October 12, 1907.

² Ibid., December 28, 1907.

³ Therapeutic Gazette, March, 1908.

⁴ Journal of the American Medical Association, December 21, 1907.

In a study of the blood pressure, John¹ has made some observations which still further emphasize the necessity for rest during the convalescence from the acute infections. He not infrequently noted in patients convalescing from the acute infections that if they were gotten out of bed and allowed to stand erect the pulse rate would rise from 72 to 110 or 120, or even 140. As the pulse rate rose the pulse became smaller and the patient felt dizzy. Returning the patient to bed caused the pulse to decline. The blood pressure under these circumstances showed a distinct fall in systolic pressure. Because of this weakness of the vascular system after the acute infections, John advises having the patient get up and stand while the pulse is noted for from five to ten minutes. If the pulse rises from 70 to 110 or 120, rest in bed is needed for some time longer. The pulse should not rise in these cases above 100.

In those diseases in which the heart is the organ at fault rest should be maintained until it is apparent that it is properly carrying on its functions. No time limit can be set on this period; the length and severity of the illness and the condition in which the heart emerges from the fight must largely determine the length of time necessary.

Another disease in which abstinence from exercise or exertion is necessary during the acute stages is *tuberculosis*. Here the danger lies not in the heart but in the increased combustion which exercise and exertion bring about. The whole tendency of tuberculosis during its acute stages is to tissue waste, and this must be combated by absolute rest and an ample diet.

An article by Paterson² on the treatment of tuberculosis has aroused a great deal of attention. Paterson is now subjecting the patients under his care at the Brompton Hospital's Sanatorium at Frimley to graduated labor, instead of having the exercise consist wholly of walking.

On admission, patients are divided into two groups: (a) those with early disease, *i. e.*, evidences of infiltration in one or two lobes; and (b) those with more extensive disease.

Special attention is also paid to the general condition of the patient and his freedom from constitutional symptoms (fever, rapid pulse, loss of weight). This is important, for a case with very slight physical signs may be suffering from severe constitutional symptoms, and for this reason be utterly unsuited for work, while another case may show marked physical signs but have no fever or other untoward symptoms and do very well at work. Work or exercise of any kind is to be avoided during the acute stages, no matter how slight the physical signs are.

The patients were first put on walking exercise, the distance being gradually increased up to ten miles a day. They were then set to work using the shovel and spade. As this plan proved successful and free

¹ Deut. Archiv f. klin. Med., July, 1908, Nos. 5, 6.

² Lancet, January 25, 1908.

from danger, certain graduated tasks were planned, such as carrying baskets of mould or other material, using a shovel and pickaxe.

Patients who were able to work six hours daily were then put to work at their trades for three weeks prior to their discharge, in order to harden the muscles used in the particular trade. The women were assigned tasks, such as bedmaking, scrubbing floors, kitchen gardening, and poultry farming. As already stated, this scheme has excited considerable comment. Ewart¹ has called it "epoch making," and Kingston Fowler, in commenting on the plan, says: "No one who has watched the change in the physical condition which in the course of six months or less occurs in these patients when daily engaged in graduated labor, a change so great that at the end of their treatment they look more like navvies than consumptives, can imagine that a like effect can ever be produced by the administration of any drug."

As an example of what may be accomplished, it may be said that patients to the number of 344 built in two years and a half a reservoir 108 feet long, 58 feet wide, and 13½ feet deep, capable of holding half a million gallons of water. This required the removal of 4175 tons of earth, which was conveyed varying distances in baskets and barrows. The laying of the concrete and other necessary tasks were also performed by these patients. As an editorial article² states: "The accomplishment of such an enormous piece of work by sick men—sick with a disease which but a few years ago was almost universally regarded as hopeless—is certainly a striking proof of our advance in the management of pulmonary consumption."

Discussions as to priority are profitless and in the main had best be avoided. That Paterson's scheme of graduated labor is a new innovation and "epoch making" in its importance must, however, cause some surprise to those of us who have been working with this plan for some years. From the opening of the White Haven Sanatorium, in 1901, up to the present time, a period now of nearly eight years, graduated labor has been in force with the patients treated in that institution. The plan was inaugurated for two reasons: First, the funds available were in the beginning so meagre that the work about the place had to be performed by the patients. This is one reason why the maintenance at the White Haven Sanatorium is probably the lowest of any similar institution in the world. A second reason for the establishing of this plan was because the patients, with few exceptions, are drawn from the laboring classes. Manual work is all most of them are suited for. For this reason they cannot be pampered and spared as the well-to-do classes are. Work must be their portion as soon as they return to their homes, and, as already stated, this work is in the great majority of instances manual labor.

¹ PROGRESSIVE MEDICINE, September, 1908, p. 40.

² New York Medical Journal, August 8, 1908.

In dealing with the tuberculosis problem in the laboring classes a little reflection will convince anyone that the plan of treatment must, of necessity, differ from that pursued in those who can adapt their future life to their physical condition. Doubtless better immediate results could be obtained by prolonging the rest period and providing exercise of a light character, but if the laboring man is to be hardened to re-enter the struggle for existence, it must be by means of work such as he will have to return to. In certain cases this plan may cause patients to break down who might otherwise get well. If, however, a man has no money and must make his living, his ability to do so must be determined as early as possible. Aside from a limited period of isolation, we do not accomplish much if a patient relapses a few months after leaving the institution.

The plan in operation at White Haven is as follows: Patients on admission are received in the infirmary and are kept there for from two to four weeks, for the purpose of determining the temperature, pulse rate, etc. If they are deemed suitable at the end of this period they are then transferred to one of the shacks and started in on one hour's work daily. The amount of work is increased from five to twenty minutes daily until the patient reaches eight hours a day. Patients who can work eight hours a day for one month are considered suitable for discharge.

The contra-indications for work are hemorrhage or bloodspitting, temperature 99.5° F., pulse constantly over 100, pleurisy, gastro-intestinal disturbance, marked loss of weight, or any intercurrent affection. I have on several occasions subjected patients to an increase in work with a persistent afternoon temperature of 100° F. This has been done, however, only when every other means had been unsuccessfully tried. It occasionally happens, why I do not know, that the exercise will cause the fever to disappear.

The work performed consists of practically all there is to do about a large institution. The farming, grading, laundry work, kitchen work, etc., are all done by the patients.

That there is, as Paterson states, a marked prejudice to this method I know. But it exists largely in the minds of those who are treating the well-to-do and the moderately well-to-do patients. People in these classes either do not have to work or are possessed of a profession which does not entail severe physical exertion.

The question of work is not confined to the sanatorium alone, but becomes of increasing importance in the after-care of tuberculous patients. In an article on the after-care of tuberculous patients I¹ have called attention to some of the defects in our campaign against the disease. It has been demonstrated beyond any doubt that tuberculosis is curable

¹ Medical Record, February 1, 1908.

in its early stages and that of all chronic diseases it is most amenable to treatment. But in the working classes many patients who would otherwise remain well, after being put in a good condition of health, relapse because of failure to obtain work or because the work is not adapted to their physical condition. In the well-to-do classes employment enters into the question but very slightly, but for the laboring man wage-earning ability is his one asset, and without it he soon becomes a public charge.

The question of the character of work to be done depends entirely on the physical condition of the individual. For those who have had very slight trouble the question is usually easily solved. But for those who have had considerable pulmonary damage the amount and character of the work they are to perform must be carefully considered. Many of them are capable, at the best, of but a few hours' work daily if they are to retain the advantages gained in the sanatorium.

The great essential for the tuberculous patient is that his work must be free from incessant hurry and great muscular effort. For a varying length of time the ambition to excel must be subordinated to the maintenance of health. The temptation to earn large wages has not infrequently led to relapses because the individual has been forced to overtax his strength.

There can be no doubt that the advice so commonly given to tuberculous cases to obtain outside employment is erroneous. A little reflection will show that, for one thing, outside employment is not easy to obtain, and that for another, the majority of outside jobs demand severe muscular exertion. The best advice to give patients leaving the sanatorium is for them to return to their former employment, provided the employment itself has not been the exciting factor in the development of the disease. A man can always earn his living much easier at work with which he is familiar than in an entire new line of employment.

Inside work has the disadvantage of being confining, but, provided the working place is fairly well ventilated and the individual keeps in the fresh air after working hours, this is not a serious drawback.

In the cities, especially during winter, fresh air must be obtained at night, and for this reason going to bed early is essential. Going to bed early also fulfils another condition, namely, the obtaining of a maximum amount of rest, which is so essential for the convalescent tuberculous individual who has to return to work on leaving the sanatorium.

Fresh Air. The treatment of *pneumonia* by fresh air, the "twenty-three-hour treatment," as Northrup has termed it, has now passed the experimental stage and can be said to be firmly established. In the beginning the reports on this method came largely from those having hospital services and who could thoroughly try any innovation in treatment. Very often a method of treatment may be successful in a well-equipped hospital and be almost impractical in private work. The Brandt method of treating typhoid fever is an instance.

That the fresh air treatment of pneumonia is practical in private work and under almost any conditions, is evidenced by the numerous reports and letters from all parts of the country and from what one learns from one's medical friends. While the profession has been almost unanimously won over to the value of this method of treatment, the laity is as yet not converted. Old ideas as to the danger of draughts are tenaciously held, and many look with horror on subjecting a patient to the very thing which is popularly supposed to have given him his pneumonia. Another misconception, from which physicians themselves are not entirely free, is that so long as the air in the room is cold the desired end is being attained. Stale air, hot or cold, is not the object; what is wanted is *fresh air*.

These points are well brought out by Fussell.¹ He states that opening the windows and keeping them open all hours of the day and night cannot be carried out in private practice without the complete concurrence of the members of the patient's family. It is necessary to convince people that "catching cold" is not the result of free ventilation, but is due to the breathing of vitiated air, which so lowers the vitality that infections readily occur.

Fussell states that in his hospital work the windows of the ward devoted to pneumonia patients are kept open constantly. Since this plan has been adopted the patients have been more comfortable and have required but little medication.

In regard to the question of cold air, Fussell points out, what was emphasized in the review for last year,² that the essential thing is fresh air. He cites an instance of where the temperature in the room was reduced to 60° F. by excluding heat but not by opening the windows. As a result, the air, although cold, became vitiated through being constantly breathed over and over again.

Kilmer³ reports on 16 cases of lobar pneumonia and 20 cases of *bronchopneumonia* in dispensary babies. The mortality in this series was 2.77 per cent. He states that while many of the parents of these babies were ignorant, he experienced no difficulty in having them carry out the necessary measures.

Rennie⁴ believes that the fresh air treatment tends to shorten the disease. Whether this is true or not, it is certain that the necessity for medication is much less than with the older methods and the patients are more comfortable. In Rennie's experience the effect of the fresh air on the pulse is marked and cardiac stimulants are rarely needed. Furthermore the tongue becomes moist and clean, the appetite improves, and sedatives are only occasionally required. The disappearance of

¹ Therapeutic Gazette, March, 1908.

² PROGRESSIVE MEDICINE, December, 1907, p. 296.

³ Journal of the American Medical Association, July 25, 1908.

⁴ British Medical Journal, August 31, 1907.

dyspnea and cyanosis and freedom from nervous symptoms have been noted by all who have written on the subject.

As yet a sufficiently large number of cases have not been treated to determine whether this method has reduced the mortality from pneumonia. G. W. Norris¹ has recently analyzed several hundred cases of pneumonia treated at the Philadelphia General Hospital since patients have been isolated in a freely ventilated ward. These cases are contrasted with a series of 991 cases previously reported from the same hospital by Ashton and myself,² and which had been subjected to all methods of treatment. The mortality in the series prior to the fresh air innovation was 53 per cent. While Norris' series showed a slightly reduced mortality, it was not striking. It must be remembered, however, that patients in this hospital, representing, as they do, the wrecks of humanity, offer a very poor chance for any method of treatment. If the mortality rate was but little influenced, it is worthy of remark that the patients suffered very little from annoying symptoms. This was especially noticeable when patients were transferred from the general ward to the pneumonia ward. A man who, in the general ward, was dyspneic, cyanotic, and mildly delirious would be quickly relieved of the symptoms after his transfer to the pneumonia ward. This is certainly a serious criticism on the ventilation usually in force in general hospital wards, a point especially emphasized by Gilman Thompson in last year's review.³

Northrup,⁴ who has done so much to advance the acceptance of fresh air in the treatment of acute infections, gives some valuable suggestions in regard to the care of patients who are sleeping out of doors. It is not generally appreciated that a patient, even with a number of blankets over him, can suffer greatly from the cold coming up from below. Northrup advises in order to prevent this that a layer of paper be placed below the mattress; beneath this is placed a blanket which should surround the mattress completely and come up on all sides. The sides of this blanket are then brought up and fastened in the middle above the patient. Over this one or more blankets can then be placed. In this way the patient is protected perfectly from draughts beneath the bed.

Tuberculous patients sleeping out of doors should have their beds prepared in this way. Canton flannel sheets are much more comfortable than cotton or linen sheets when sleeping out of doors.

While the fresh air treatment reduces the necessity for medication to a minimum, it must be borne in mind that medication, particularly stimulation, is at times needed. As Fussell⁵ points out, a pneumonia patient should be seen at least twice in twenty-four hours. Twenty-four hours

¹ Paper read before Section of Medicine, College of Physicians, Philadelphia, 1908.

² *American Journal of the Medical Sciences*, June, 1905.

³ *PROGRESSIVE MEDICINE*, December, 1907, p. 296.

⁴ *Medical Record*, April 4, 1908, p. 586.

⁵ *Loc. cit.*

is an abundance of time for a weakened heart to become so feeble that it fails before any remedy administered can be of effect.

Discussions as to the most suitable climate for tuberculous patients continue, although it is noticeable that they are less frequent than they were several years ago. There are still those who believe the *sine qua non* is altitude, or a maximum amount of sunshine or a minimum amount of rain, disregarding the plain fact that cases are being cured in every variety of climate, both good and bad.

Pottenger¹ has published a paper extolling the advantages of a low altitude. This article has been reviewed *in extenso* by Ewart.²

One of the major fallacies concerning the climatic requirements for *tuberculosis* is the question of sunlight. When all other considerations are waived, it is insisted that sunlight is the great essential. This idea has prevailed for years, and is probably due to two causes: (1) The early climatic resorts were situated in places with a mild climate, which enabled people to live out of doors, and for the same reason led to the windows and doors of houses being kept open day and night. (2) After the discovery of the tubercle bacillus it was found that this organism could not survive exposure to daylight, and in the direct rays of the sun quickly died. The last-named reason is the one usually given for subjecting patients to sunlight.

Knopf,³ in an article on "Sunlight and Solar Therapy," insists on the great advantages of sunlight. In support of this argument he points out the prevalence of tuberculosis in the dark, unlighted tenement houses. It is unquestionable that properly lighted and ventilated rooms are essential to health, but this does not imply, of necessity, sunlight. The argument that those climates with a maximum amount of sunshine give the best results is not supported by facts, although most health resort prospectuses emphasize the number of clear days in the year.

In this country the Adirondack region has enjoyed and still enjoys the deserved reputation of producing splendid results in tuberculosis. It is a well-known fact that the best results are obtained in this region in the winter months, when the sun is not seen for days at a time. This I know from personal experience. The winter I spent in this region was characterized by an almost constantly overcast sky and the sun was not seen for ten days and two weeks at a time. So far from being an unusual winter, it was, if anything, an open one, with more sunshine than is usually encountered. My experience at White Haven, Pa., has been similar to this.

The ill effects of sunshine has recently attracted much attention, largely because of the publications of Woodruff. If the testimony of

¹ Journal of Balneology and Climatology, January, 1908.

² PROGRESSIVE MEDICINE, September, 1908, p. 36.

³ American Medicine, July, 1908.

patients is to be believed, constant sunshine day after day is not an unmixed blessing.

It would seem that the advantage of sunshiny days is not because of any especial curative effect they may produce, but because they are conducive to cheerfulness; and even this advantage is not free from ill effects.

In previous reviews I have referred to the ill-considered advice so frequently given consumptive patients regarding change of climate. Dr. B. B. Bagby,¹ of Carrizozo, New Mexico, points out some of the disadvantages of this region. The lack of rain and poor water supply generally and the wind and dust storms are disadvantages but little appreciated in the East. The advice he offers in sending patients to New Mexico applies to all health localities. He states that too many patients are sent away with no other advice than "go West," and with the assurance that the climate is sure to cure them. Many of them find their way into cheap boarding houses and so-called sanatoria. Many of these so-called sanatoria lack a competent physician, offer the poorest accommodations, and are hot-beds of infection.

"Pure air is a great help in the cure of tuberculosis, but rest, good food, and the direct supervision of a competent physician are essential. The person who has to work for a living will be much better off in the East, where wages for easy jobs are to be had and living is cheaper. All the positions requiring light work are greatly overcrowded in the Southwest."

The gradual appreciation of the facts just quoted is leading more and more to the adoption of "*home treatment*." This is manifest not only by the encouraging results reported in private work, but also in the establishing of dispensaries and sanatoria throughout the country irrespective of climatic advantages. The part played by dispensaries in the tuberculosis crusade is yearly assuming larger proportions. Farrand² gives the following figures showing the remarkable growth of these clinics:

Previous to 1905	15
During 1905	3
During 1906	9
During 1907	28
During 1908 (January 1 to June 1)	85
Total	140

Browning³ outlines a plan for the establishment of dispensaries and sanatoria which will enlist the nation, State, county, or municipality, as may come within the province of each.

The State of Pennsylvania⁴ has been particularly active in this regard,

¹ Journal of the American Medical Association, June 6, 1908, p. 1918.

² Journal of the Outdoor Life, July, 1908.

³ Journal of the American Medical Association, September 14, 1907.

⁴ Ibid., May 30, 1908.

as it now has, under the supervision of the State Board of Health, a dispensary in each county; sixty in all. The City of Philadelphia has, in addition to the State dispensary, six or seven additional clinics operated by hospitals.

These dispensaries and the tuberculosis classes instituted by Pratt, of Boston, are methods of home treatment that are achieving splendid results and are demonstrating that tuberculosis can be cured in the home surroundings in a large city.

The following figures taken from the report of the Relief Committee of the Committee of the Prevention of Tuberculosis of the New York Charity Organization Society¹ are most encouraging and instructive. In regard to "home treatment," they report on 127 patients treated exclusively in their homes for a period of twenty months. Out of 35 cases classed as incipient, 23 (66 per cent.) were materially improved at the end of the term of treatment. Of 80 cases originally diagnosticated as moderately advanced, 41 were improved; while of 12 cases, classed as far advanced, one was improved, and all were made more comfortable. Another fact concerning these advanced cases is that they were placed in circumstances and given instructions which rendered them less likely to be sources of infection for others.

Miller,² in some introductory remarks on the work of the committee, states that home treatment has of necessity come to occupy an important place in the crusade against tuberculosis.

"This does not by any means warrant the influence that the beneficial effects of sanatoria and favorable climates have been relegated to the background. It is simply a realization of a well-recognized fact that for numerous and various reasons, reasons complicated in every possible fashion by the complex medical and social factors involved, the great mass of sufferers from tuberculosis will or must remain in their homes.

"When we add to this consideration the fact that patients treated in sanatoria, hospitals, and health resorts come from these homes originally, and that to them they must return to take up their permanent mode of life, it is evident that the homes cannot be denied the central and commanding position in our struggle against tuberculosis."

The opinion just quoted is the position held in these reviews for the past few years. For those who can avail themselves of sanatorium and climatic advantages, by all means let them do so; but for the great majority such advantages are not possible. However unpalatable this fact may be, it is, nevertheless, the truth.

Seaside sanatoria for the treatment of *surgical tuberculosis* in children are believed to be the best method of dealing with this form of the disease, although it is not by any means certain that such sanatoria located in the

¹ Charity Organization Society, March, 1908.

² Journal of the Outdoor Life, July, 1908.

inland will not give as good results. Curling,¹ in last year's review, was quoted as expressing a preference for treating surgical tuberculosis in places with a moderate altitude away from the seashore. Halsted has also had successful results from subjecting patients with surgical tuberculosis to the same *regime* as the pulmonary cases. This is, after all, the essential feature rather than any curative effect of the seashore per se.

There can be no doubt, however, that excellent results are obtained at the seashore. Most of our information on the outdoor treatment of surgical tuberculosis is based on results obtained at sanatoria so situated. Ely and Whitbeck² report on three and one-half years' experience at the Sea Breeze Hospital for the treatment of Surgical Tuberculosis. They believe that sanatoria so situated give the best results. They urge the importance of having a competent orthopedic surgeon in attendance at these institutions. Richardière³ recommends for children with enlarged tuberculous glands sea air combined with sea bathing and local applications of sea water. The fright induced by forcible bathing in the sea may be unfavorable to a cure in children under three years of age and had best be omitted. Individuals with pulmonary involvement also do not do well under this method of treatment. And, I may add, cases of pulmonary tuberculosis, as a general rule, do not do well at the seashore.

Iodalbin is an organic compound containing 21 per cent. of iodine in combination with egg albumin. It is in powder form, of reddish color, is practically tasteless, and of a rather pleasant odor. It is insoluble in water, acid, alcohol, and in all ordinary solvents, but is slowly soluble in alkaline solvents.

Bremerman⁴ has given the drug a thorough trial for the past four years and now feels justified in recommending its use. He states that iodalbin is particularly serviceable in three conditions, *i. e.*, *syphilis*, *metallic poisoning*, and *rheumatism* of the subacute type in which the joints are still swollen and obstinately resist ordinary remedies. The drug can be substituted for iodide of potassium in practically every condition in which that drug is indicated.

Iodalbin may be administered in powder form or in capsules. It is administered in doses of 5 to 10 grains three times daily, preferably before meals. This dose may be increased 5 grains daily up to the desired amount.

Bremerman's conclusions are as follows:

1. It is practically tasteless, whereas the iodides commonly used are very distasteful.
2. It passes through the stomach unchanged and does not cause gastric distress, as do the alkaline iodides.

¹ PROGRESSIVE MEDICINE, December, 1907, p. 301.

² Medical Record, March 7, 1908.

³ Annales de Médecine et Chirurgie Infantiles, June 15, 1908.

⁴ Therapeutic Gazette, March, 1908.

3. Being stable and insoluble it may be administered in powders, tablets, or capsules; in water, coffee, chocolate, wines; and, in fact, any beverage or food not alkaline in reaction.

4. It passes through the stomach unchanged, but it becomes dissolved in the alkaline secretions of the intestines and is slowly absorbed.

5. The drug becomes soluble before absorption, and does not produce the exaggerated effect which follows the absorption of the very soluble iodides of the alkalies.

6. A less quantity of iodalbumin is necessary to produce an effect than the alkaline iodides.

7. The substance is non-toxic.

8. It may be used for the same purpose and under exactly the same conditions as the iodide of potassium and sodium.

For an excellent review of the iodides and their substitutes (other than iodalbumin) see Gottheil's article in *PROGRESSIVE MEDICINE* for September, 1908, p. 140.

Iodine. Within the past few years iodine has been advised in a number of surgical conditions. Roop¹ has had excellent results from iodine in the treatment of *ulcers*. He first treated the ulcers by painting the skin surrounding them up to the edge. Later he applied the iodine over the surface of the ulcer itself and found this an excellent method for converting it into a clean, granulating wound which readily healed. The iodine is used every day until the slough separates, when an ordinary dusting powder is applied. If unhealthy or superfluous granulations appear, the iodine should again be applied. Roop has also used the iodine locally in affections of the mouth and throat. He states that it will arrest and cure pyorrhea alveolaris, and suggests its use in *cancerum oris*.

Roop employs the iodine in a concentrated form or in a saturated solution in alcohol.

McCurdy² advises the sterilization of *infected bone cavities*, whether in the central canal or the surface, with tincture of iodine (U. S. P.). Wounds treated in this way heal in from four to five weeks regardless of the size. The cavities and sinuses are best disinfected by injecting the iodine through a syringe such as dentists employ for cleansing the mouth. McCurdy condemns the practice of packing these cavities with gauze every day, as it breaks down and destroys the blood clot which is necessary for the repair of the tissues. Mild toxic symptoms are sometimes noticed but seem to have no ill effects.

Durante³ advocates iodine in *surgical tuberculosis*, and claims to have had better results than from radical operations. Finocchiaro,⁴ both from

¹ Journal of the American Medical Association, May 30, 1908.

² American Journal of Orthopedic Surgery, July, 1908.

³ Policlinico, 1908, No. 2; Journal of the American Medical Association, April 4, 1908.

⁴ Ibid.

experimental and clinical observations, advocates the use of iodine in *tuberculous epididymoöorchitis*. He injects into the parenchyma of the testicle a few drops of a 1 per cent. solution of iodine in distilled water, with iodide of potassium as a solvent. He makes about thirty injections, increasing a few drops each time.

For cases of *puerperal sepsis*, in which the symptoms are due to absorption of septic material from retained secundines, Robins¹ gives the following directions: The patient should be brought to the edge of the bed. The cervix is then seized with a pair of volsellum forceps and brought down. The cavity of the uterus is explored with a dull curette and embryotomy forceps. The uterus is then dried with cotton on a pair of dressing forceps and freely swabbed out with a pledget of cotton saturated with Churchill's iodine. If the uterus does not drain freely a rubber tube is inserted. The iodine applications are kept up daily until the temperature reaches normal and remains so for several days.

The value of the iodine in these cases lies in the fact that it is not only an efficient antiseptic, destroying germs with which it comes in contact, but it has the additional advantage of penetrating into the soft boggy tissues. The iodine is also absorbed and follows along the same channels as the infection.

Where there has been delay, and serious complications and constitutional infection are present, the iodine treatment is not indicated.

Iodoform. Iodine is thought by some to exert a very favorable effect on tuberculous processes, and in some form or other has long been employed in this disease. Iodoform by means of inunction is recommended by S. F. Wilcox² for *tuberculous peritonitis*. As the drug must be in solution to be of any benefit, he advises the following formula:

Iodoform	5ij
Ether	f3iiss
Olive oil, or	
Cod-liver oil	q. s. f3viij

The inunction is applied to the abdomen night and morning. Wilcox does not mention the amount used at each inunction.

Europhen oil has been used in pulmonary cases for the purpose of introducing iodine into the body. I have used it, but cannot say that I have seen any great benefit from it.

Mercury. The question as to whether *syphilis* can be prevented once inoculation of the virus has occurred is an interesting one. It has been held by syphilographers, since the time of Ricord, that once infection took place nothing could prevent the occurrence of the constitutional signs. Of recent years, however, there have been recorded cases in which

¹ Charlotte Medical Journal, April, 1908.

² Medical Record, May 2, 1908.

ablation of the chancre, soon after its appearance, has prevented constitutional syphilis.

Gottheil¹ has recently drawn attention to several cases in which ablation was successful. A still more promising method is that advocated by Metchnikoff. It will be recalled that Metchnikoff succeeded in preventing the appearance of constitutional syphilis in apes and, in one instance, in man by thoroughly inuncting the site of infection with calomel ointment. This ointment is composed of calomel, 33 parts; vaseline, 10 parts; and lanolin, 67 parts. The ointment should be applied within twelve to eighteen hours from the time of the suspicious intercourse. Now that the specific cause of syphilis has been discovered, it is not hard to understand why the local application of mercury has this effect.

Wolbarst² has recently reported a case, apparently successful, from the prophylactic use of mercury. Doubtless there will be some who will oppose this use of the drug on the ground that it will tend to increase illicit intercourse. But as an editorial article³ points out: "Men will consort with unclean women, or women who are presumptively unclean, in spite of the teachings of religion and the warnings of medicine—they have done so from the dawn of history, and there is nothing in the present state of society to lead us to hope that they will not continue to do so. If it be allowable to cure a gonorrhea rapidly by irrigations or other therapeutic measures, why should it be forbidden to take similar measures to prevent the occurrence of syphilis?"

Two years ago the views of a number of syphilographers were given, and attention was especially directed toward the importance of general hygienic measures in addition to the use of mercury and the iodides. Pedersen⁴ also emphasizes this point. Whenever possible he orders the patient to take a vacation in order that all his energies may be directed toward improving his general health. For those who are unable to avail themselves of this advantage their daily life is outlined. Their diet should be simple and nutritious, they should abstain totally from tobacco and alcohol, keep early hours, obtain a maximum amount of fresh air and properly regulated exercise.

The mouth should receive careful attention. In the absence of ulceration, cleansing the teeth three or four times daily is sufficient. For this purpose, as well as gargling the throat, Pedersen recommends liquorsii antiseptici alkalini, which is diluted with equal parts of water. For simple reddening and tenderness of the mucous membrane of the gums and mouth the following is most efficient:

R—Potassii chloratis	3j
Aquae	Oj—M.

Sig.—Use as a mouth wash or gargle two or three times daily.

¹ PROGRESSIVE MEDICINE, September, 1908.

² Medical Record, October 24, 1908.

³ Ibid., November 30, 1907.

⁴ Vermont Medical Monthly, May, 1908.

For flabby conditions of the mucous membrane the following is serviceable:

R—Acidi tannici	℥iss
Glycerini	℥iij
Aquæ	q. s. ad ℥vj—M.
Sig.—Use, undiluted, as a mouth wash or gargle three or four times daily.	

One of the first things to be considered in the treatment of syphilis is the condition of the teeth. During the period before antisyphilitic treatment is begun a dentist should be consulted.

In regard to the specific treatment of syphilis there is the greatest variety of opinion as to the most suitable form of mercury and the best method of its administration. Of recent years there have been an increasing number who advocate the hypodermic method, claiming for it better absorption, more accurate dosage, and complete control of the patient.

After all, it is probably as true of mercury as it is of quinine that favorable results will be obtained if administered "in adequate doses in a proper form, at a proper time, and during a considerable period."

At the present time the great majority of patients are treated by internal administration, and, except in comparatively rare instances, this is efficient and gives good results. Pedersen states that the forms of mercury most generally used for internal administration are the protiodide, the biniodide, the bichloride, calomel, and blue mass, and the frequency of their use is probably in the order named. From this list the combination of mercury and chalk should not be omitted, as it is most serviceable, particularly in those with a tendency to looseness of the bowels. Pedersen does not advise mercurial fumigation or inunctions, believing that there is no way of regulating the dosage, and, as a result, serious symptoms may result. It should not be forgotten, however, that the administration of mercury by way of the skin is the method *par excellence* in treating hereditary syphilis in infants and young children.

In spite of the enthusiastic claims by some observers for the hypodermic method, Pedersen, in common with most, would reserve this method for those cases in which, for various reasons, a rapid impression is necessary. The indications for this method are the presence of a chancre on the face or other exposed part, extensive secondary eruptions in the same situations, rapidly progressing lesions, threatened nasal or palatal perforation, or implications of the nervous system.

The method of using the hypodermic treatment has been fully explained by Gottheil in *PROGRESSIVE MEDICINE* for September, 1906 and 1907.

Other moot questions regarding the treatment of syphilis are: (1) The length of time necessary to achieve a cure, and (2) the use of the iodides. Pedersen believes that a patient should be under treatment for not less than three years. How long mercury should be given alone, when com-

bined with one of the iodides, or stopped entirely and the iodides alone administered, are questions open to discussion.

The plan most generally used as soon as the diagnosis is definitely decided is as follows: What is known as the "tonic dose" is first determined. This is discovered by administering the protiodide, preferably, in $\frac{1}{4}$ -grain doses, in pill form three times daily. Every other day this dose is increased by one pill daily until the patient manifests symptoms of intolerance (tender gums, fetid breath, loose bowels, or griping pains in the abdomen). The dose is then reduced one-half and the patient kept on this amount of mercury for *eighteen months*. If at any time the symptoms again become urgent the drug is pushed to the point of tolerance. If the nervous system or any vital organ is threatened the drug is pushed, and if favorable results do not occur promptly, iodide of potassium is also given.

After eighteen months the so-called "mixed treatment" is given or iodide alone for from *six to twelve months* longer. During this period the iodide is given in from 5- to 10-grain doses three times daily. For the tertiary manifestations of syphilis the dose of iodide of potassium is much larger. There is some difference of opinion as to how much should be given in these conditions. Some believe that 20 to 30 grains three times daily are sufficient; others, among whom may be mentioned Gottheil,¹ advocate, in some cases, enormous doses. Pedersen recommends mixed treatment for the squamous or tuberculous syphilides.

Pedersen advises if the bowels are too loose the temporary use of small doses of opium. During the early months of treatment it is his custom to combat the anemia by some form of iron, such as Bland's pill or reduced iron. The use of tonics will largely depend on the condition of the patient's appetite.

Examination of the urine of individuals to whom mercury is about to be administered for any length of time is of the utmost importance. Indications of a kidney lesion, no matter how slight, call for the utmost caution in exhibiting mercury even in syphilitics. This point has recently been urged by a number of observers. The condition of the kidneys in syphilis and the use of mercury in syphilitic nephritis is very fully dealt with by Bradford in the present volume.

Another important point to bear in mind is that individuals who have once had syphilis had better be submitted to a short course of treatment (six weeks) every spring and fall. The importance of this procedure becomes apparent when it is taken into consideration that freedom from nervous or tertiary manifestations cannot be guaranteed even after a thorough initial treatment. Thus Schlosberg,² in an investigation of 1500 prostitutes who had been thoroughly treated, found 137 in whom tertiary symptoms developed. In common with other observers he

¹ PROGRESSIVE MEDICINE, September, 1908.

² Hygiea, May, 1908; Journal of the American Medical Association, August 8, 1908.

found that the extent and severity of the secondary symptoms did not seem to have any connection with the prognosis, except possibly that the milder secondary manifestations were oftener followed by tertiary symptoms. The interval between the infection and the occurrence of the tertiary symptoms ranged from one to twenty-six years, averaging from four to eleven years.

Schuster¹ has reported 235 cases of nervous syphilis (tabes, paresis, cerebrospinal syphilis), 186, or 77 per cent., of which had previously undergone mercurial treatment, 19 per cent. having had as many as eight or nine series of inunctions. The interval between the appearance of the initial lesion and the nervous manifestations was no shorter in the patients who received only a few inunctions than in those who received many. Schuster attributes these late nervous manifestations to the presence of antibodies which the mercury fails to entirely eliminate in all cases.

The combination of *syphilis* and *tuberculosis* is an unfortunate one, particularly if both diseases are active. Opinion is divided as to the effect of mercury on tuberculosis. It is held by many that the continued use of mercury has a decided tendency in many cases to aggravate tuberculous lesions, and if administered to cases suffering from both syphilis and tuberculosis, the latter disease is not uncommonly made worse.

Bernart² has published some interesting observations on this subject. He states that when mercury is administered by intravenous injection the drug causes certain actions exclusive of antisyphilitic ones. This is especially true of the bichloride. The bichloride causes a reduction in the temperature and, in addition, acts as a sedative. Owing to this antipyretic and sedative action, the drug for a time seems to have a favorable effect on tuberculosis, which, however, is soon lost. This action of the bichloride was utilized by Basso³ in *puerperal staphylococcemia*. In one of three cases treated in this way there was a disappearance of the chills and fever, followed by recovery. Bernart comes to the following conclusions regarding the use of mercury in individuals suffering from both syphilis and tuberculosis: (1) The control of the active syphilis in many of the tuberculous patients seemed for the time to benefit the tuberculosis also. (2) In patients with pulmonary tuberculosis, after the first control of the syphilis and if the treatment was continuously pushed, a few months would show a gradual aggravation of the tuberculosis. (3) The genito-urinary tuberculous patients, outside of the benefit to their syphilis, showed no improvement in their tuberculosis. (4) Two patients with tuberculous eye trouble were benefited, one markedly so and the other but moderately so. This is not surprising, as the intravenous injections

¹ Monatsschrift f. Psychiatrie und Neurologie, November, 1907, p. 474.

² New York Medical Journal, June 27, 1908.

³ Ginecologia, April 30, 1908; Journal of the American Medical Association, August 8, 1908.

of mercuric chloride exert a decided beneficial influence over infections and ulcerations of the eye. (5) The patients with pulmonary tuberculosis evidently suffering from the absorption of septic materials, probably due to a secondary germ infection, were decidedly benefited up to a certain point, after which, if the mercurial treatment was continued, their retrogression was rapid. Wright¹ states that he found that in patients suffering from both syphilis and tuberculosis the symptoms and physical signs due to the tuberculosis were greatly benefited by mixed treatment. He accordingly placed a number of tuberculous cases on mixed treatment. Two of these cases he reports in detail and refers to 33 others still under treatment. As a result of the administration of this treatment there was almost immediate improvement in all the symptoms and clearing up of the physical signs in the lungs. Furthermore, advanced tuberculous ulceration in the larynx and pharynx is cured in a remarkably short time.

Wright² has published an additional paper on this treatment, reporting 34 patients improved, which brings the percentage of improvements to 85. He has at present 65 patients under treatment, and is of the belief that the results in these cases will surpass those in the 40 cases already reported. He states that many of the patients at present under treatment are well or far advanced in the disease. His method is as follows: An injection of succinimide of mercury (gr. $\frac{1}{3}$) is given every other day until thirty injections have been given. Then potassium iodide (gr. 10) is given three times a day for two weeks. A week is then allowed to elapse without any treatment, and then the injections are resumed. The mercurial solution is made of sterilized distilled water, so that $m\lambda x$ will equal gr. $\frac{1}{3}$. The injections are given intramuscularly in the buttocks after thorough sterilization of the part. The bichloride of mercury (gr. $\frac{1}{20}$) may be used by mouth in some cases.

Grünberg³ also claims to have obtained good results from the use of mercury and the iodides in tuberculosis of the upper air passages.

These observations are completely at variance with the usually accepted opinion. The diagrams illustrating the extent of the pulmonary damage in some of Wright's cases depicts disease of such an extensive character that it is inconceivable that mixed treatment or any other form of treatment would have any affect. Another objectionable feature in this method of treating tuberculosis is the use of potassium iodide. As was pointed out in *PROGRESSIVE MEDICINE* for last year (page 303) this drug has a decided tendency to cause a breaking down of tuberculous lesions.

Criticism of a method, which has, as yet, not been tried by unpreju-

¹ U. S. Naval Medical Bulletin, April and July, 1908.

² New York Medical Journal, August 29, 1908.

³ Münchener med. Wochenschrift, August 6, 1908.

diced observers, is perhaps unfair, and I shall wait with much interest the results obtained by others.

Nitrites. The almost universal introduction of blood-pressure instruments and the numerous investigations concerning the pathological changes in the bloodvessels have led to a somewhat better understanding in regard to the use of the nitrites. Until comparatively recently *arteriosclerosis* and hypertension were almost synonymous and from a therapeutic standpoint seemed to demand one of the nitrites. Furthermore, it was taught that the increased tension must be lowered at all costs.

Recent investigations have demonstrated that the condition which has always been considered as arteriosclerosis is in reality the end result of the various causes which lead to the visibly and palpably thickened arteries and that before this stage is reached there is a gradual change, the symptoms and signs of which are as yet but illy understood.

From a therapeutic viewpoint it is important to keep in mind that while an abnormally high arterial pressure is evidence of disease, it is often also a compensatory action and to abolish it altogether or to unduly lower such a pressure may be dangerous. In other words, hypertension bears the same relation to some individuals that a hypertrophied heart does to an individual with chronic valvular disease. It is Nature's method of adjusting things to altered conditions. So long as the bodily functions are properly carried on direct interference is to be avoided and efforts should be directed to maintain the present equilibrium through regulation of the diet, exercise, etc. When the arterial changes and the resultant hypertension are due to a specific poison, such as lead or syphilis, active therapeutic measures should be instituted to remove, if possible, the underlying cause. Vaquez¹ states that the more advanced the arterial changes become the more inconstant and transient is the effect of the nitrites. For habitual hypertension they should never be used constantly as they may then be unavailable at a time they are critically needed. The only one of the nitrites he would except for constant use is the *spirit of nitrous ether*. This drug, he claims, is more of a circulatory sedative than the other nitrites, and does not have the same effect as a reducer of tension. He advocates the prolonged use of the spirit of nitrous ether in doses of from 30 to 60 minims daily. This use of the nitrous ether does not contra-indicate the administration of one of the other nitrites when prompt action is desired.

Vaquez's statement that the more advanced the arterial disease the less effective is the nitrites is further elaborated by H. A. Hare.² Hare points out that the ability of the nitrites to lower blood pressure depends largely on the degree of spasm present. If the vessels are tortuous and fixed, but little benefit is to be expected from the nitrites. He also states that failure to obtain results with nitroglycerin is not infrequently

¹ Archives des Maladies du Cœur, des Vaisseaux, et du Sang, January 1, 1908.

² Therapeutic Gazette, April, 1908.

due to not giving the drug sufficiently frequently and in inadequate doses, or to the use of stale preparations. If nitroglycerin is to be used for reducing blood pressure it should be given for the physiological effect. This requires its administration every two or three hours; giving it in doses of $\frac{1}{100}$ grain three times daily is useless.

The transient effect of nitroglycerin is to be borne in mind. The fleeting action of the drug reduces its field of usefulness largely to one where an immediate result is desired. For prolonged effects the sodium nitrite is the preferable drug to employ in cases of hypertension. Hare states that the sodium nitrite is, furthermore, less apt to produce headache and other symptoms characteristic of the other nitrites, because it acts so slowly. Cook¹ also recommends the sodium nitrite as the most stable and dependable of the nitrites.

The use of the nitrites in the management of arteriosclerosis depends, then, largely on the amount of spasm present. In combating hypertension due to arterial fibrosis, especially if the fibrosis is due to a specific cause, such as syphilis, lead or gout, the iodides must be used for a prolonged period of time. In these cases the nitrites are only available, if at all, to avert some sudden catastrophe, as an apoplexy.

Mills,² in an article on the general management of arteriosclerosis, is disappointed with the results obtained by drugs commonly recommended for the reduction of tension. He states that in his experience *morphine* or *opium* is the best drug to lower arterial tension. The value of morphine in cases of hypertension probably depends on its sedative action with consequent relaxation of arterial spasm.³ Allbutt⁴ utilizes this effect of morphine in certain cases of *angina pectoris*. He points out that morphine does good in many cases of angina not only by relieving pain and diminishing excessive reflex activity, but also, perhaps, by causing relaxation of certain areas of the bloodvessels, which, being in spasm, throw upon the heart too severe a labor. As Hare points out, however, morphine will not remove the ill effects of hypertension if fibrosis is the underlying cause.

Rankin,⁵ in an article on "angina pectoris," states that the treatment must be considered under two heads: (1) the management of the attack itself, and (2) the measures necessary between attacks.

For the attack itself he recommends the immediate injection of *morphine*, gr. $\frac{1}{4}$, the effect of which is increased by the addition of *atropine*, gr. $\frac{1}{100}$. According to Rankin the morphine not only relieves the pain, but it also reduces the peripheral resistance by dilating the smaller vessels. Allbutt,⁶ as already stated, ascribes the good effects of morphine in these cases to the relief of pain, diminution of reflex activity, and the

¹ Journal of the American Medical Association, February 29, 1908.

² Australasian Medical Gazette, January 20, 1908.

³ Hare, loc. cit.

⁵ Clinical Journal, November 6, 1907.

⁴ Folia Therapeutica, 1908.

⁶ Loc. cit.

relaxation of spasm. Allbutt's reason for combining atropine with the morphine is that the atropine is a powerful sedative or depressant to the peripheral ends of the vagi, and that by its use impulses may be blocked which, arising in the pneumogastric centre, would otherwise reach the heart, and thereby cause the conditions which are associated with angina.

According to Allbutt the use of morphine in angina is indicated in cases in which the symptoms are not the result of high tension. He calls attention to the fact that pain is a potent factor in raising tension and that in not a few cases of angina the increase in the tension is due to the pain and not the pain to the tension. In these cases the nitrites are not indicated in his opinion. Rankin gives inhalations of *amyl nitrite* in addition to the morphine. The latter drug is contra-indicated if the angina is associated with cardiac failure of pulmonary edema. *Caffeine* or *ether*, hypodermically, are indicated in these cases.

It occasionally happens, Rankin states, that the *amyl nitrite* fails to act promptly and the inhalations must be repeated until the morphine has time to act. At times the *amyl nitrite* fails altogether; in such instances a few whiffs of *chloroform* seldom fail to give relief. Inhalations of oxygen are often serviceable.

Some patients find the *amyl nitrite* very disagreeable. Rankin recommends in these cases, for self-administration, tablets containing 1 minim of a 1 per cent. solution of nitroglycerin. A rapid effect is obtained by instructing the patient to nibble one of these tablets and allow it to dissolve in the mouth before swallowing.

If *amyl nitrite* is not available practically the same effect can be obtained by the hypodermic administration of $\frac{1}{50}$ grain of nitroglycerin. Vaquez¹ states that he has abandoned the other nitrites entirely in favor of nitroglycerin in the treatment of angina pectoris.

In between attacks Rankin recommends the following medicinal treatment to keep the tension low: Blue mass, 1 to 2 grains, combined with 3 grains of rhubarb once a week, the bowels being kept gently open at other times by a morning dose of Carlsbad salts. The following formula is serviceable as a substitute for the more expensive waters:

R.—Sodii chloridi	℥j
Sodii bicarbonatis	℥ij
Sodii phosphatis	℥iv.—M.

Sig.—One to three teaspoonfuls in a glass of warm water.

If the arterial tension increases Rankin administers *sodium* or *potassium iodide* in 10-grain doses, combined with 1 to 2 minims of a 1 per cent. solution of nitroglycerin and 3 minims of Fowler's solution three

¹ Loc. cit.

times daily after meals. This mixture can be safely given for months if care is taken to omit it one week out of each four.

It is of course understood that the management of these cases demands a careful supervision of the diet and the avoidance of overexertion and excitement of any kind.

In the review of last year and the year before the use of amyl nitrite for *pulmonary hemorrhage* was mentioned. The testimony of all who have employed amyl nitrite in this condition is distinctly favorable to its use. Personally I have found it very serviceable. During the past year Braga,¹ Campani,² Tochi,³ and Placak⁴ have written on the efficiency of amyl nitrite for the control of pulmonary hemorrhage.

Three to five minims of amyl nitrite are inhaled, and this may be repeated once or twice during the day. As a rule, the hemorrhage stops at once. For small, recurring hemorrhages or persistent blood-streaked sputum the sodium nitrite may be used, providing the blood pressure is high. If the pressure is low *ergot* has been suggested as the more preferable drug.

J. M. McCarthy⁵ recommends *nitroglycerin* in the treatment of *puerpal eclampsia*. He found that the drug was more efficient when administered hypodermically than when given by mouth. McCarthy admits that the number of cases treated by means of nitroglycerin is too small, and that a larger series of cases might not give such good results. Of 15 cases of eclampsia which have come under his observation, 5 did not receive nitroglycerin; 3 of these died; of 2 receiving the drug internally, 1 died; of 8 cases receiving the nitroglycerin hypodermically, 7 recovered and but 1 died.

Davis,⁶ in a study of the *blood pressure in eclampsia* as an indication for treatment, concludes that in all cases there is a high blood pressure, and the most successful remedies in treating the condition are those which reduce the pressure and promote the elimination of toxins. In addition to vapor baths, puncture of the membranes and venesection, he recommends nitroglycerin.

Amyl nitrite and nitroglycerin, when given hypodermically, have a marked sedative action on the motor side of the spinal cord, in addition to lowering the blood pressure. This offers a partial explanation as to their value in eclampsia. Whether the diuretic action of the drug has any influence is problematical; some observers deny any such effect. This use of the drug is worthy of trial, as it need not conflict with other methods of treatment.

Another condition in which nitroglycerin has been recommended is

¹ Gazzetta degli Ospedali, December 22, 1907.

² Ibid., March 8, 1908.

³ Ibid., 1908, No. 11.

⁴ Cleveland Medical Journal, July, 1908.

⁵ British Medical Journal, May 23, 1908.

⁶ University of Pennsylvania Medical Bulletin, May, 1908.

neuritis. Stevenson¹ reports 32 cases of chronic, subacute, and acute neuritis in which the use of nitroglycerin gave most encouraging results. In the acute cases the effect of the drug was manifest within forty-eight hours.

His method of administering the drug is as follows: Beginning with $\frac{1}{100}$ grain every eight hours the interval is reduced one hour in every twenty-four hours until the full physiological action of the drug was manifest or the patient was taking $\frac{1}{100}$ grain every three hours, at which interval it was continued. The headache and flushing may be controlled with small doses of sodium bromide. In cases of idiosyncrasy the interval between doses is lengthened. *Sciatica* seems to be especially benefited by the treatment. Inasmuch as nitroglycerin in medicinal doses has no effect on the sensory apparatus it is not usually recommended for painful conditions other than angina pectoris. Stevenson's explanation of the benefit in neuritis is that the drug dilates the arterioles of the sheath and nerve, thus leading to a better circulation and absorption of the inflammatory exudates.

Several cases are on record in which the ingestion of large quantities of *bismuth subnitrate* have been followed by symptoms of poisoning. Bennecke and Hoffman reported in 1906 the case of an infant that suddenly died after the administration of a bismuth emulsion for radiographic purposes. At autopsy methemoglobinemia was found. Böhme² has recently recorded a similar case. Three hours after the administration of the bismuth emulsion the child was seized with abdominal pains, vomiting and diarrhea, cyanosis, which steadily became more marked, dyspnea, collapse symptoms, and death within thirty minutes of the onset. At the autopsy methemoglobinemia was found.

The clinical and pathological picture so closely resembled *nitrite poisoning* that a chemical examination was made. This examination confirmed Böhme's suspicions. He then instituted some experiments on the subject. The result of his investigations showed that when the fecal matter of infants and bismuth subnitrate are brought into contact the formation of nitrites may occur. Therapeutic doses of bismuth subnitrate even in infants are probably incapable of producing ill effects, but the large quantities employed in radiographic work should be used cautiously. Two years ago Pancoast reported untoward results in an adult; the symptoms were not serious.

It has been suggested that *bismuth hydroxide* be substituted for the subnitrate in radiographic work.

Permanganate of Potassium. Judging from the reports of the past three years permanganate of potassium is now the generally accepted treatment for the *bites of venomous snakes*. In outlining the course of treatment to be pursued in cases of snake bites, Prentiss Willson³ states

¹ Medical Record, May 16, 1908.

² Arch. f. exper. Path. u. Pharm., 1907, p. 441.

³ Archives of Internal Medicine, June, 1908.

that a ligature should be applied at once; in case the bite is on the head or body the affected part should, if possible, be frozen as the only quick method of retarding the circulation and absorption. The ligature should not be left on too long and should not be released suddenly, as rapid absorption of the poison and sudden death may follow. If the patient is seen at once the ligature should shut off the circulation completely until local measures can be instituted. He states that a ligature is of doubtful utility if constitutional symptoms are in evidence and the local lesion is badly swollen.

After applying a ligature, if one is not already applied, multiple incisions should be made through the swollen area, the part kneaded and immersed in a warm, antiseptic solution in order to promote hemorrhage and the escape of serum. This will hasten the escape of sufficient poison to allow of the ligature being gradually loosened. Willson states that the local antiseptic to be used is a 1 per cent. solution of permanganate of potassium.

Locally, Braddock¹ advises incision through the tooth punctures, rubbing crystals of permanganate of potassium into the wound, the injection of a strong solution of permanganate in a ring around the wound and then washing out the wound freely with permanganate solution. This method of using permanganate has been referred to in previous numbers of *PROGRESSIVE MEDICINE*, December, 1905, p. 286; December, 1906, p. 326; and December, 1907, p. 261.

Willson does not believe in either alcohol or strychnine as stimulants in these cases. The condition to be met is that of shock with profound lowering of blood pressure. For this purpose Willson advocates absolute rest, lowering of the head, external heat, the hypodermic use of adrenalin solution (15 minims, 1 to 1000 solution) and saline solution intravenously, by hypodermoclysis or interoclysis.

"Serum treatment, so far as this country is concerned, does not exist."

Picric Acid. The old method of treating *burns* and *scalds* with oily substances is now rarely employed. Those having the largest experience in the treatment of these conditions now employ the same general principles of antiseptic surgery used in lacerated or incised wounds. Picric acid seems to be the most popular local application. A series of articles recommending picric acid dressings was reviewed in *PROGRESSIVE MEDICINE* for last year.²

Sutcliffe³ also believes that picric acid is the most efficient dressing that can be employed in the treatment of burns and scalds. It is sterile and antiseptic; the discharges are absorbed; it may be left on for forty-eight hours; and it is stimulating to the new tissues. Sutcliffe saturates the dressings in a 5 per cent. solution. The strength recommended last year was 1 per cent., or $\frac{9}{10}$ of 1 per cent. The author refers to the

¹ New York Medical Journal, November 9, 1907.

² December, 1907, p. 310.

³ British Medical Journal, August 3, 1907.

explosive character of the picric acid crystals and the consequent danger of carrying them on shipboard. In view of the great value of the drug in the treatment of burns and scalds, so apt to occur on men-of-war, he believes that this danger may be disregarded if suitable precautions are taken.

Out of a great many cases treated with picric acid Sutcliffe states that he has never seen symptoms of poisoning due to absorption. The rarity of untoward effects following the local use of picric acid was concurred in by those writing on the subject last year. Untoward effects do occur, however, due, probably, to idiosyncrasy. Such an instance has been reported by Meurice.¹ A child with a small burn was treated with a solution of picric acid. Within twenty hours of the application of the solution she developed headache, vertigo, nausea, and vomiting. The urine was brownish in color and contained methemoglobin and albumin. Picric acid was also recovered from the urine. On removing the picric acid solution the symptoms gradually cleared up.

Dark-red, frothy urine is not uncommonly met with in patients submitted to this treatment. As a rule the analyses of such urines have been negative. The discoloration is thought to be due to hemoglobinuria and some carboluria. It is of no significance.

Picrotoxin. Paterson² has found picrotoxin an efficient means of preventing the nausea which follows chloroform or chloroform-ether anesthesia. He has compared the results obtained in cases treated with picrotoxin with those not receiving it. The difference was especially marked in those who had suffered severely from nausea after previous anesthetics. Paterson employs the picrotoxin in a 0.2 per cent. solution in sterile water. He injects 20 minims of this solution into the subcutaneous tissues. For a child of four years 5 minims is sufficient. The injection is given as soon as the anesthetic is stopped. If some nausea follows the first injection a second one, half as large, is given.

Psychotherapy. At irregular intervals questions arise in medicine which occupy for a time a large share of attention. Sometimes the subject is entirely new; at other times it is a revival of an old principle, which suddenly excites interest.

As a result of what is now known as the Emmanuel Church Movement a large number of papers have appeared on the subject of psychotherapy. The sudden interest that has been created in this subject has given the impression that psychotherapy is something new. All who have recently written on the subject have pointed out that so far from being new psychotherapy is one of the oldest methods of treatment known, and that consciously or unconsciously, psychotherapy has probably been practised since the dawn of medicine.

Practically every physician is today employing this method in one

¹ *Annales de la Société de Médecine de Gand*, 1907, p. 166.

² *Lancet*, September 14, 1907.

way or another. Often those who are most successful in the practice of medicine are those whom Nature has endowed with what is vaguely known as a personality. They unconsciously have the power of creating powerful mental impressions on their patients and are possessed of a firm belief in the medicine they administer. Medicines given with the assurance that they will act in the manner desired, often do so act; a fact that has led Barker¹ to remark that "One thing that makes judgment so difficult regarding pharmacotherapy in any given case is the lack of means of determining satisfactorily the part which psychic influences have played in the result obtained. We must be grateful to experimental pharmacology for the help it promises to bring. It has been well said that 'it is we ourselves who give to many medicaments their efficacy and their effects persist as long as does the faith of physicians and patients in their virtue.'"

So far as I know no one has as yet been able to establish successfully a healing cult, who has not been possessed of a strong personality. The success of Christian Science and to a less degree of Dowieism is based entirely on the strong personality of their leaders. This endeavor to cure disease by personal influence has always been popular and presents nothing new. "Not to go farther back, Macaulay observed of Joanna Southcott, who was born in 1750: 'We have seen an old woman with no talents beyond the cunning of a fortune teller, and the education of a scullion, exalted into a prophetess and surrounded by tens of thousands of devoted followers, many of whom were, in station and in knowledge, immeasurably her superiors; and all this in the nineteenth century; and all this in London.'"²

Legitimate psychotherapy, as we know it today, dates from the publication of Weir Mitchell's book, *Fat and Blood and How to Make Them* (1877), and is now generally referred to as the "Rest Treatment" or Weir Mitchell treatment. Dr. Mitchell³ has recently published a paper in which he describes the gradual evolution of the method in his hands; its reception by the profession; and its limitations. It seems hardly necessary to call to mind the well-known principles of this method, namely: seclusion, rest, massage, full feeding, and electricity. Nor, perhaps, is it necessary to remind my readers that this plan originally intended for functional nervous disorders, has in some form or another found a place in a wide variety of diseases; just as fresh air first advised for pulmonary tuberculosis is now being advocated for many other conditions.

As Dr. Mitchell has pointed out in his paper the needs of each case, in which his method is employed, must be carefully studied. Thus absolute rest in bed may not be needed; forced feeding may be abandoned for an ordinary diet; and electricity may be substituted for those rare

¹ Journal of the American Medical Association, August 1, 1908.

² Editorial, *ibid.*, June 13, 1908, p. 1987.

³ *Ibid.*, June 20, 1908.

cases in which massage cannot be applied. "I have no doubt," he says, "that very many cases of hysteria, neurasthenia with obsessions and the like have been cured by simple country doctors using full rest treatment and nothing else. You cure the body and somehow find that the mind is also cured. The histories of nerve wounds in war amply illustrate this truth. The hardy soldier becomes a timid, hysterical, petulant patient. With relief of pain and return of health of body and flesh and color he regains health of character—a common story, most illustrative."

Dercum¹ has also pointed that all the functional neuroses are characterized by a more or less unusual impairment of the general health, and that they are to a great extent the expression of asthenic states, and that improvement of the nervous symptoms ensues on improvement of the general health.

The accepted psychotherapeutic methods of today are as follows: (1) The use of hypnotic procedures (this method has by common agreement a very limited field); (2) the appeal to suggestibility in the waking state; and (3) the resort to educational or persuasive measures (Mills²).

Burr³ gives as the essential features of psychotherapy: education, encouragement, waking suggestion, suggestion under the hypnotic state, and those occult and mystical and so-called religious means of cure. This last feature he utterly condemns as it differs from psychotherapy as practised by the physician in that there is claimed for it some power outside of the physician himself as being the thing that does the work. Burr makes a distinction between encouragement and suggestion. In encouragement there is simply a plain talk with the patient, pointing out to him his error and showing him that his condition is favorable for recovery. In waking suggestion the attempt is made to act on the patient's "unconscious mind," causing him to create in his own mind, without knowing that the physician has caused it, a feeling of well being in the future.

Dercum⁴ considers psychotherapy under the following heads: (1) General methods, including mental rest, mental exercise, and mental gymnastics; (2) special methods, including normal suggestion, direct and indirect; (3) hypnotism and suggestion under hypnotism; and (4) the psychoanalytic method by Breuer and Freud. In regard to the method of Breuer and Freud, which is comparatively recent, it may be stated that it originally was based on the fact that obsessions could be dispelled if the patient could be aroused to recall the memory of the event which was causal to the development of the symptom, together with the accompanying emotion. In addition the patient is allowed the fullest possible description of this event. In other words,

¹ *Therapeutic Gazette*, May, 1908.

² *Monthly Cyclopedic and Medical Bulletin*, July, 1908.

³ *Transactions of Philadelphia County Medical Society*, 1908.

⁴ *Therapeutic Gazette*, May, 1908.

it is based on the principle that many people are relieved of great mental stress if they can give free expression to what is worrying them. Physicians, other than neurologists, have noted this as have also clergymen. The comparative ease with which people will reveal otherwise jealously guarded secrets to physicians and clergymen has doubtless something to do with the taking up of psychotherapy by the latter profession; but of this later.

According to Dercum the method of Breuer and Freud should not be practised for several reasons, the chief of which are that Freud believes that nervous obsessions, hysterical and otherwise, have their origin in some passionate sexual action or aggression of childhood. On this basis each case is attacked. Furthermore, the time required is "a drawback, as it takes from six months to three years for a cure and many sittings, each requiring an hour or more. For those interested in the details of this method Dercum's original article should be consulted.

In regard to the advisability of clergymen practising psychotherapy it is the almost unanimous opinion of physicians that it is a grave mistake. Mills¹ says: "I repeat, therefore, that psychotherapy, like medicinal or mechanical or surgical or climatic or any other sort of therapy, belongs to the physician and not to the clergyman, however sincere the latter may be in his idea that it is his duty to invade the province of his medical brother."

Nor are all clergymen of the same opinion as Drs. Worcester and McComb, who inaugurated this movement. A Unitarian clergyman, the Rev. Dr. Crooker,² of Boston, says of mental therapeutics that "To carry it into the noisy marketplace and exploit its merits with the waving of banners and the blare of trumpets will cause more invalids to suffer fresh torments and create more new patients with serious disorders than many a doctor can cure. What is most needed is indirection, delicacy, and privacy. To get up a spectacular procession, to flourish gorgeous standards and to shout aloud to the crowd, 'Come all ye that are sick and be mentally healed'—to follow this course is to invite seven devils to enter and take possession where only one previously existed." While it is true that the mental clinic of Drs. Worcester and McComb requires a doctor's diagnosis in order to rule out any organic disease, what of those cases in the incipient stage of some grave mental disorder? Alienists are now appreciating the importance of detecting mental diseases in their incipency so that an early cure can be attained.

The distinction between an ordinary functional neurosis and an incipient insanity or what may become insanity is a difficult problem, a problem far too intricate for a layman, no matter how deep his psycho-

¹ Monthly Cyclopedia and Medical Bulletin, July, 1908.

² Pennsylvania Medical Journal, July, 1908, p. 818.

logical knowledge. The right step has been taken in this respect by the establishing of a "mental clinic" at the Orthopedic Hospital, Philadelphia.

The scope of psychotherapeutic methods is summarized by Dercum¹ as follows: "We should always bear in mind that the symptoms that our patients present have a physical basis, and especially is this true of the functional nervous diseases. States of exhaustion play a fundamental role in all of them, and Janet has pointed out that when the general level of the mental tone is raised obsessions disappear. It would seem, then, that attention to the physical condition of the patient, the bringing up of his health to the highest possible level, must be the first object of our treatment. In other words, simple physiological procedures, rest, full feeding, gentle exercise, massage, bathing, and like measures, should be instituted in every case. In obsessional states there is essentially a neurasthenia, or, to use the more fashionable latter-day term, psychasthenia; it is the underlying asthenia which first demands our attention.

"Rest and physiological measures can be applied according to the character of the case from partial methods up to a full rest cure. Added to these conditions we should institute such simple psychotherapeutic measures as mental rest, especially such as is secured by the isolation of the patient; secondly, the restraining of the patient; later on special mental exercises or mental gymnastics, if necessary. During all of the time judicious use should be made of normal suggestion, both direct and indirect. Under direct suggestion we should include such an explanation to the patient of his condition as may be adequate and tactful, pointing out that his symptoms are functional and that they will in time disappear. That normal suggestion acts powerfully when the level of the general health is improving goes without saying. Suggestion under hypnotism is in my judgment rarely if ever justified. Psycho-analysis will probably, for reasons already given, never find a permanent place in our therapeutics."

It must be clearly borne in mind that psychotherapy is not a "cure all," but is distinctly limited to functional nervous disorders and incipient mental disease. Organic disease is never cured by this method. Mitchell² says that "there is no scientific record of any case of organic disease having been cured by any form of influence exerted through the mind of the patient. It is clear that in all time in the past the lesser neuroses have been in some cases made well or relieved by influences exerted through the mind. As these influences never cure organic maladies nor true insanities, the miraculous, as an explanation, may be excluded."

Christian Scientists have as a rule shrewdly availed themselves of this knowledge. Cabot,³ who has analyzed a number of their cures, has

¹ Loc. cit.

² Loc. cit.

³ McClure's Magazine, August, 1908.

found that with hardly an exception they were instances of functional neuroses. He could find no authentic instance of an organic disease having been cured. In spite of their insistence of the non-existence of disease faith curists rarely treat organic troubles or the acute infections. Occasionally an overzealous follower of the cult attempts to exercise his powers in an acute infection with the not infrequent result that the patient dies and a lawsuit follows.

Success in the employment of psychotherapeutic measures depends largely on the personality of the individual using them, and for this reason some men will necessarily obtain better results than others.

Quinine. On several occasions in these reviews reference has been made to the treatment of *pneumonia* by massive doses of quinine, and reasons have been given why such treatment is dangerous. This applies not only to quinine, but to iodide of potassium, digitalis, and other drugs which have been exhibited from time to time. In most instances the evidence upon which these results have been based has been insufficient; this is especially true of the quinine treatment.

Having had 25 cases of pneumonia without a death Payne¹ expresses the opinion that in quinine we possess a most efficient method of treatment.

Alvarez² gives some interesting information on this subject which amply bears out the theoretical objections that have been raised against this method of treatment. He states that he was soon impressed with the absolute harmfulness of the quinine. In his experience and that of others it is not unusual for the quinine to be vomited shortly after administration. When it is retained a sthenic case is frequently transformed into what resembles a bad case of typhoid and recovery is slow, with delayed resolution, empyema, femoral phlebitis, and other sequels. Tinnitus and blindness are not infrequent occurrences, and are not always recovered from. The statement that tinnitus and other signs of cinchonism are not common after the massive doses, Alvarez explains by saying that this may be due either to the quinine being vomited or else to the typhoid state of the patient who is too apathetic to complain of anything.

In PROGRESSIVE MEDICINE³ for last year the contrasting views on the subject of *malarial hemoglobinuria* were given. The most divergent opinions are expressed even by those having the widest experience in the treatment of malaria. Several interesting articles on malarial hemoglobinuria have appeared during the past year.

Deaderick⁴ states that at present there are three theories as to the cause of blackwater fever: (1) that it is malarial; (2) that it is the result of

¹ Charlotte Medical Journal, March, 1908.

² Journal of the American Medical Association, June 13, 1908, p. 1936.

³ December, 1907, p. 314.

⁴ Memphis Medical Monthly, December, 1907, January, February, March, 1908.

quinine poisoning or the abuse of quinine; and (3) that it is a disease of itself associated with malarial infection.

Deaderick takes the side of those who view blackwater fever as a malarial infection. But while he is of the opinion that malaria is essentially and solely the predisposing cause of blackwater fever, he thinks it is only in some cases that it is the actual exciting cause. In Deaderick's experience the majority of these cases recover when large doses of quinine are continuously employed. Those instances in which the quinine seems to exert a deleterious effect are in his opinion the result of coincidence.

McCay¹ advances the theory that the hemoglobinuria is the result of the salt of quinine which is employed and that the sulphate is peculiarly prone to produce evil results. Thus he arrays himself with those who consider blackwater fever as not depending on the malarial infection, but as being due to quinine poisoning. According to McCay, the *hydrochloride of quinine* fails to produce hemoglobinuria in cases in which the sulphate has produced this disaster. He therefore recommends that the hydrochloride be employed in place of the sulphate.

This theory, however, does not explain satisfactorily the relationship of blackwater fever to malaria and to quinine. This is shown by the fact that a large proportion of severe malarial infections are not complicated by hemoglobinuria, even if sulphate of quinine is administered, nor does it explain why, that in certain districts, hemoglobinuria, in association with malarial infection, is exceedingly prevalent, even if no quinine is administered.

Lukis² is of the opinion that hemoglobinuria, at least as it occurs in India, is nothing more nor less than quinine poisoning. He has to admit, however, that quinine has failed to produce hemoglobinuria in certain districts. In order to explain this fact and also to controvert Stephens' statement that in India the distribution of malaria and blackwater fever coincides very closely, he supports the view that the condition is a disease of itself. The cause of this condition he believes to be the Leishman-Donovan body. This would explain why certain districts in India are much affected with hemoglobinuria, while other districts are not; in other words, it is the association of the Leishman-Donovan body with the malarial parasite that produces the condition.

The theory that blackwater fever is independent of both malaria and quinine and is due to a distinctly third factor, is not a new one. In addition to the Leishman-Donovan body proposed by Lukis, it has been suggested that the *Bacillus megatherium* may be the exciting factor. The theory that a third factor is the true exciting cause has much to recommend it, although there is lacking, as yet, definite proof of its exact nature.

¹ Indian Medical Gazette, 1908.

² Ibid.

At the present time the strongest support seems to be for the theory that attributes the hemoglobinuria to a hemolytic action which is primarily due to the malarial parasite, and, secondarily, to quinine. Bignami¹ believes that an alteration occurs in the blood plasma as the result of the changes which take place in the red corpuscles which are infected by the malarial parasite, with the result that a substance is developed which is hemolytic in its nature.

Stephens has stated that the two main factors in the production of blackwater fever are malaria and quinine. Why quinine will at one time produce hemolysis and at another time will not remains unknown. McCay's² theory that the sulphate of quinine is responsible for the hemolytic action has already been mentioned. It has also been claimed that when the quinine is administered hypodermically, hemoglobinuria does not occur.

Several very encouraging reports have appeared on the use of quinine in *exophthalmic goitre*. Lancereaux³ claims that the symptoms of Graves' disease are due to vasodilatation of the vessels of the head and neck. As a result of this vasodilatation there is enlargement and excessive functioning of the gland, cerebral symptoms, tachycardia, tremor, and emaciation. Lancereaux was led to use quinine because of its vasoconstricting action on the vessels of the head and neck. He reports favorable results in twenty-one cases.

The quinine is administered in 15 to 22 grains at the evening meal. The dose is divided into three parts and administered at fifteen-minute intervals. Lancereaux starts with $7\frac{1}{2}$ grain doses and gradually increases. The drug is given for twenty days and then suspended for ten days. He also uses, in addition to the quinine, *ergot* in doses of from $1\frac{1}{2}$ to $7\frac{1}{2}$ grains. The *ergot* is given in the morning.

Jackson and Mead⁴ have had excellent results with quinine in Graves' disease. They report 42 patients cured (76 per cent.); 7 patients benefited (13 per cent.); and 6 failures (11 per cent.). While it is not claimed that the cures are permanent, the patients are free from signs and symptoms and are able to perform their work. Relapses are not common, but when they do occur they yield very quickly to the quinine.

Jackson and Mead recommend the *hydrobromide of quinine*; the salt must be neutral and not acid. They administer the quinine in 5-grain doses in capsules three times daily; some patients can take 4 capsules without developing tinnitus, while others cannot take more than 2. The treatment must be persisted in for at least two years. Lancereaux obtained his results in six months. In addition to the quinine Jackson and Mead instituted general treatment such as rest, diet, care of the stomach, intestines, and skin. Usually, after a week or two, the pulse

¹ Therapeutic Gazette, July, 1908, p. 478.

² Loc. cit.

³ Bulletin de l'Académie de Médecine, Février 25, 1908.

⁴ Boston Medical and Surgical Journal, clviii, 1908, 346.

rate will be lowered, the gland diminished in size, and the sweating and tremor are lessened.

No bad results have been noticed except a slight tinnitus if too large doses have been employed. The treatment is continued until all the symptoms have disappeared; this may be in four months or not for three years. Jackson and Mead do not offer any explanation as to how the quinine acts in Graves' disease.

Salicylates. While the salicylates are not absolutely specific for *acute articular rheumatism* in the sense that mercury and quinine are for syphilis and malaria, salicylic acid or one of its derivatives gives the best results in the management of rheumatism. Dosage and the form of the drug to be used vary greatly, however. The salicylate of sodium is at present the most popular preparation. It will be recalled that in last year's review large doses of this drug were advocated. Phillips and Clarke¹ showed that the drug could be given in doses of 200 grains in twenty-four hours, and that in some instances the amount administered reached 300 to 360 grains. These large doses are rendered possible by the simultaneous administration of *sodium bicarbonate* which seems to counteract any toxic symptoms that may arise.

N. S. Davis² states that in his hands the salicylate of sodium has given the best results, and that the sodium salicylate prepared from oil of wintergreen is best tolerated by the stomach. *Salol* and *salophen* are available for mild cases of rheumatism only; they cannot be given in sufficiently large doses in the severer cases.

Davis administers the drug in capsules to be followed by sufficient water to ensure solution and dilution of the drug in the stomach. In place of pure water a charged solution of bicarbonate of sodium or effervescing sodium or potassium citrate may be drunk, thus combining the alkaline treatment with the salicylates.

In the discussion of Davis' paper Anders³ advocated pushing the drug until slight toxic effects (ringing in the ears) are produced. As a rule he believes that 120 grains daily are sufficient; but in a robust individual the dose may be increased to 180 grains or more. The majority of those discussing this paper seemed fearful of the large doses advocated by Phillips and Clarke, alleging that serious untoward effects were likely to occur. Although Davis referred to the administration of an alkali with the sodium salicylate, it was for the purpose of combining the alkaline and salicylate methods of treatment. None of those taking part in the discussion referred to this combination as a means of avoiding serious untoward symptoms on the part of the salicylates.

If an analgesic is needed for pain, Lambert⁴ states that *phenacetin*,

¹ PROGRESSIVE MEDICINE, December, 1907, p. 317.

² Journal of the American Medical Association, December 21, 1907.

³ Ibid.

⁴ Ibid.

gr. 5, and *morphine*, gr. $\frac{1}{12}$, are four times more effective than either remedy alone.

The remarkable results obtained in *tonsillitis* by the local use of *aspirin* was first called attention to by Kieffer.¹ Fetterolf² has recently reported a series of cases and is able to fully endorse Kieffer's claims. By applying aspirin to the tonsil the disease is shortened and the relief of pain prompt. In follicular tonsillitis the drug seems to exert a specific action, while in diphtheria no effect is noted, thus rendering the application of some diagnostic significance.

Aspirin as ordinarily dispensed is not suitable; it must be finely powdered for local use. The technique is as follows: If the tonsils are very slippery and covered with a film of mucus, as is usually the case, a solution of sodium bicarbonate, 1 to 10, is mopped over them for the purpose of cleaning away the mucus.

A piece of cotton is wrapped about the end of a throat applicator. The cotton is moistened with distilled water and then dipped into the powdered aspirin. Any excess of aspirin should be shaken off, as it may drop into the pharynx during the application and start a coughing attack. The affected tonsil is then thoroughly gone over so that the aspirin is brought in contact with the entire surface. This is repeated two or three times at each sitting. The applications are made every twelve hours. Active symptoms and most of the swelling disappear within thirty-six hours. Relief from the pain and the difficulty in swallowing takes place, as a rule, within a few hours.

If only one tonsil is involved the other one should also be treated, otherwise the disease may later appear on the unaffected side.

All that is needed for bedside work is a tongue depressor, a head mirror, and a good light.

For office work the aspirin may be forcibly blown on the tonsil by means of a large silver Eustachian catheter.

Von Gresic³ has had excellent results from the employment of aspirin in *bronchial asthma*. The aspirin seems to lessen the severity of the attack and shorten its duration. In the severer cases morphine combined with the aspirin gives the best results.

Sulphate of Magnesium. The extraordinary results obtained in acute inflammatory conditions by the local application of magnesium sulphate was mentioned in *PROGRESSIVE MEDICINE* for last year.⁴ Tucker⁵ has contributed another paper on magnesium sulphate, showing the wonderful effect the local application of the drug has in the treatment of *erysipelas*. In 35 uncomplicated though severe cases, all recovered within from two to seven days; pain and the usual local discomfort was

¹ American Medicine, September, 1906.

² Therapeutic Gazette, November, 1908.

³ Klinisch-therapeutische Wochenschrift, 1908, xv, 96.

⁴ December, 1907, p. 321.

⁵ Therapeutic Gazette, June, 1908.

relieved in a few hours. No internal or specific treatment was given to 19 cases with severe erysipelas, a number of them suffering from some serious disease (nephritis, heart disease, pneumonia), and but 3 died.

The treatment is carried out as follows: "The application consists of a saturated solution of magnesium sulphate in water. This is applied in facial cases on a mask consisting of from fifteen to twenty thicknesses of ordinary gauze, of sufficient size to extend well beyond the area involved, a small opening being made to permit breathing; no opening, however, is cut for the eyes. The mask is then thoroughly saturated with the solution, applied and covered with oiled silk or wax paper and wet as often as necessary to assure a moist dressing—usually once in two hours, depending on the time of year or the temperature of the room. The dressing should not be removed oftener than once in twelve hours to permit inspection of the parts, and then immediately reapplied; the infected area should not be washed while the treatment is employed."

The advantages of this form of treatment are as follows:

1. "The drug can be obtained in any country store, is easily made into solution, is inexpensive, non-toxic, and clean; it is also easy of application if the directions are properly followed.

2. "The patient very promptly obtains relief from the distressing local symptoms usually present.

3. "The temperature falls to normal, usually during the second twenty-four hours, and does not rise again, thereby eliminating possible complications from fever.

4. "Internal medication is not indicated in uncomplicated cases, the only treatment being a mild diet for the first few days, or, to be more accurate, until the temperature reaches normal."

Tucker has now treated over seven hundred cases of various forms of inflammation, with uniformly good results.

H. A. Hare¹ confirms these good results from personal experience. In discussing Tucker's paper he related an interesting clinical experiment. Having, until he learned of the magnesium sulphate applications, always employed ichthyol in the treatment of erysipelas, he tried in one case the experiment of putting the ichthyol dressing on one side of the face and the magnesium sulphate dressing on the other. At the end of twenty-four hours the ichthyol side showed no change, while on the other side the signs of the disease had diminished and the patient had no discomfort on this side.

Tucker and those who have employed magnesium sulphate in erysipelas and other inflammatory conditions, are unable to offer any explanation as to how the drug acts. The interesting and important clinical fact is that it undoubtedly does accomplish what is claimed for it.

¹ Therapeutic Gazette, June, 1908, p. 409.

S. Solis Cohen¹ refers to the local application of magnesium sulphate solutions as the best method of relieving the pain in *acute articular rheumatism*.

The treatment of *tetanus* by means of intraspinal injections of magnesium sulphate was referred to in PROGRESSIVE MEDICINE for last year,² and the method of giving the treatment explained in detail. J. N. Henry³ reports four cases treated in this way: one recovered and 3 died. Powers⁴ also records a successful case treated with intraspinal injections. The incubation period in this case was ten days.

Three successful cases are reported by Greeley⁵ and Lyon,⁶ in which the magnesium sulphate solution was administered by *hypodermoclysis*. One of these cases was of the chronic type of tetanus, while the other two were acute. These results are extremely interesting, as the treatment is easily applied and was successful in the acute type of the disease which form the majority of the fatal cases. One of these acute cases received large quantities of tetanus antitoxin without producing any result, and later quickly responded to subcutaneous injections of magnesium sulphate.

Lyon injected 2 drams of the magnesium sulphate in four ounces of water on the twelfth day. In two hours there was marked relaxation of the muscles. The injections were repeated on the thirteenth, fourteenth, seventeenth, and nineteenth days. A vesicular eruption appeared all over the body on the fourteenth day; it dried up and disappeared in about one week. Greeley's cases were similarly treated.

Calcaterra⁷ has used magnesium sulphate hypodermically in *epileptics*. This use of the drug has been successful in checking the attacks.

Tuberculin. The use of tuberculin in the treatment of *tuberculosis* in its various forms is yearly receiving more attention, and the literature during the past two years contains many articles on the subject both as to therapeutic results and methods of administration.

It is as yet not possible to offer any definite conclusions as to the value of tuberculin treatment. It may be said, however, that those who have employed tuberculin over a period of many years are convinced of its efficiency; and that those who decry its use have had little or no experience with it, basing their objections on theoretical grounds alone.

It should be made clear at the outset that tuberculin therapy is not to be undertaken without due regard for the fact that tuberculin is a toxic substance capable of producing marked untoward effects if carelessly

¹ Journal of the American Medical Association, December 21, 1907.

² December, 1907, p. 319.

³ International Clinics, vol. iv, seventeenth series.

⁴ Medical Record, July 25, 1908.

⁵ Journal of the American Medical Association, September 14, 1907.

⁶ Ibid., May 23, 1908.

⁷ Gazzetta degli Ospedali, 1907, vol. xxviii; Journal of the American Medical Association, September 14, 1907.

used. For those who wish to undertake its administration it cannot be urged too strongly that the initial dose must be small and the increase in dosage cautiously made. Unfortunately no absolute rule can be laid down regarding the increase in dose or the selection of the initial dose.

The scheme most generally followed at the present time is that of Denys; but it must be remembered that this scheme is, after all, a general guide and does not apply to the individual case. The majority of properly selected cases can be treated on this plan, or on the slight modification of this plan recommended by Lawrason Brown.

The essential point is the administration of a dose which will not cause a reaction. This necessitates, in some cases, abandoning the initial dose ordinarily recommended and using a much smaller one; in other cases the rate of progression must be much slower and instead of increasing each dose the same dose may be repeated several times. In any event after a reaction the next succeeding dose should be greatly reduced, and the dose at which the reaction occurred cautiously approached.

It can safely be said, however, that so long as the doses are kept small and gradually increased no harm will result. Haste in the treatment is to be avoided above all things. Tuberculin treatment to be of value must be carried on for at least six months, and preferably one year to eighteen months (Trudeau).

There are a number of tuberculins on the market, and each has its advocates. At the present time Denys' bouillon filtrate seems to be the most popular.

The following directions as to the diluting of tuberculin and its administration are given by Ringer.¹ As a diluting fluid physiological salt solution is used, to which 0.5 per cent. carbolic acid has been added to prevent decomposition. A pipette of small calibre, containing 1 c.c. and accurately graduated to tenths of a c.c., is used. This is sterilized and filled with 1 c.c. of pure tuberculin, which is then emptied into a sterile bottle and 9 c.c. of the diluting fluid is added. This makes a 10 per cent. solution, each cubic centimeter of which contains 100 mg. of tuberculin. Proceeding in like manner, we make from this 10 per cent. solution a 1 per cent. solution, each cubic centimeter of which contains 10 mg. of tuberculin, and in similar fashion we proceed to the weaker solutions.

The solutions should be kept in a cool place, in the dark or in brown bottles, and the weaker ones (0.1 per cent. and under) should be renewed after four weeks. All turbid solutions should be discarded.

In diluting Denys' bouillon filtrate (B. F.) eight solutions are used, each one-tenth the strength of the next higher. No. 1 contains $\frac{1}{10000}$ mg. per c.c. and is for febrile cases only; No. 2 contains $\frac{1}{1000}$ mg. per c.c.;

¹ Journal of the American Medical Association, May 2, 1908.

No. 3 contains $\frac{1}{100}$ mg. per c.c.; No. 4 contains $\frac{1}{10}$ mg. per c.c.; No. 5 contains 1 mg. per c.c.; No. 6 contains 10 mg. per c.c.; No. 7 contains 100 mg. per c.c.; and No. 8 is pure tuberculin.

The following tables may be of service in preparing the dilutions:

DENYS' BOUILLON FILTRATE (B. F.).

No. 8 = 1 c.c. pure filtrate.	
No. 7 = 1 c.c. pure filtrate	+ 9 c.c. diluting fluid (100 mg.).
No. 6 = 1 c.c. No. 7	+ 9 c.c. diluting fluid (10 mg.).
No. 5 = 1 c.c. No. 6	+ 9 c.c. diluting fluid (1 mg.).
No. 4 = 1 c.c. No. 5	+ 9 c.c. diluting fluid ($\frac{1}{10}$ mg.).
No. 3 = 1 c.c. No. 4	+ 9 c.c. diluting fluid ($\frac{1}{100}$ mg.).
No. 2 = 1 c.c. No. 3	+ 9 c.c. diluting fluid ($\frac{1}{1000}$ mg.).
No. 1 = 1 c.c. No. 2	+ 9 c.c. diluting fluid ($\frac{1}{10000}$ mg.).
Initial dose, $\frac{1}{100000}$ mg.	

KOCH'S OLD TUBERCULIN (O. T.).

No. 6 = 1 c.c. pure tuberculin.	
No. 5 = 1 c.c. pure tuberculin	+ 9 c.c. diluting fluid (100 mg.).
No. 4 = 1 c.c. No. 5	+ 9 c.c. diluting fluid (10 mg.).
No. 3 = 1 c.c. No. 4	+ 9 c.c. diluting fluid (1 mg.).
No. 2 = 1 c.c. No. 3	+ 9 c.c. diluting fluid ($\frac{1}{10}$ mg.).
No. 1 = 1 c.c. No. 2	+ 9 c.c. diluting fluid ($\frac{1}{100}$ mg.).
Initial dose, $\frac{1}{10000}$ mg.	

The bacillen emulsion (a 0.5 per cent. solution of dead tubercle bacilli) is measured similarly to the bouillon filtrate (B. F.), *i. e.*, by ignoring the solid substance and taking into account only the liquid contents.

The same method is also used in diluting the tuberculin residuum (T. R.), which also contains solid substance. As both of these preparations contain solid substance the bottle should be shaken to insure an even distribution. In withdrawing these tuberculins from the stock bottle the pipette should be inserted to the middle of the fluid contents.

In administering the tuberculin a syringe holding exactly 1 c.c. and carefully graduated to tenths of a cubic centimeter is used. (A syringe specially prepared for this purpose has been made by a firm in Boston. This syringe is accurately graduated into twentieths of a cubic centimeter.) In administering Denys' filtrate (B. F.) solution No. 1 is used for febrile patients or others too sensitive to the usual initial dose of $\frac{1}{100000}$ mg. Denys recommends in sensitive patients very small doses, $\frac{1}{1000000}$ mg., or even less.

With a non-febrile patient solution No. 2 is employed, containing $\frac{1}{1000}$ mg. per c.c. and an initial dose of $\frac{1}{100000}$ mg. is given. In other words, as the syringe contains 1 c.c. one-tenth of a syringe of solution No. 2 is given. The increase, according to Denys' scheme, is at first by $\frac{1}{100000}$ mg., consequently at the subsequent dose two-tenths of a syringe is given, then three-tenths, then four-tenths, and so on until $\frac{9}{100000}$ are given.

A change is then made to solution No. 3, and the same rate of progression is observed while using this solution and those following.

Lawrason Brown¹ has modified this scheme of Denys' slightly, as follows: 1, 1.5, 2, 2.5, 3, 4, 5, 6, 8.

As the initial dose of the old tuberculin (O. T.) is larger ($\frac{1}{1000}$ mg.) fewer solutions are needed. The rate of increase is the same for the filtrate (B. F.).

The initial dose of the bacillen emulsion (B. E.) is $\frac{1}{10000}$ mg. The rate of progression in dosage is similar to the bouillon filtrate.

The initial dose of the tuberculin residuum is $\frac{1}{1000}$ mg. This form of tuberculin has been especially recommended for genito-urinary tuberculosis.

It must be borne in mind that each succeeding solution is ten times stronger than the one preceding, and in changing from one to another reactions may occur on account of the increased amount of tuberculin. For this reason it is advisable to greatly reduce the initial dose of the next higher solution.

Reactions are most apt to occur in giving tenths of a milligram of O. T., or hundredths or tenths of a milligram of B. F. and B. E. (Brown). Another important point to bear in mind is that tuberculin is not standardized, and that when prepared under the same conditions it often varies in strength, so that in using a fresh lot from another "brew" the dose should be reduced until its effect can be compared with that last used.

The tuberculin is administered twice a week. While the convenience of the person who administers the tuberculin has some influence on the time of day, Brown² is of the opinion that the evening is the best time, inasmuch as the reaction following tuberculin rarely occurs earlier than ten hours after the injection. Another important point is that the maximum temperature during the day has been attained by that time.

An interval of at least three days is necessary between doses, as a delayed reaction may not take place until sixty hours after the administration of the tuberculin. When the larger doses are reached, the interval is increased to a week or ten days.

The symptoms produced by tuberculin are given by Brown as follows: First, the localizing symptoms, and, second, the general symptoms. The former are not nearly as likely to occur as the latter unless pronounced reactions are produced, and consequently are of less importance. Increased cough and expectoration may occur, and it is usually advisable under these circumstances to omit several doses. Oppression in the chest is not infrequently noted. Pleurisy occurs so frequently in the course of tuberculosis that it is of little value as a guide. Hemoptysis is very infrequent, but when it occurs calls for a stop in the treatment until the sputum has been free from blood for at least a week.

¹ Boston Medical and Surgical Journal, July 23, 1908.

² Loc. cit.

In regard to the skin reactions at the site of the injections, Brown is of the opinion that slight local reactions can be disregarded and the dosage continued. Injections given into the tissues of the trunk (back or abdominal wall) seem less likely to produce reactions than those given in the limbs. The general symptoms are the most important and give the best clue in regard to the increase in the dose.

Brown emphasizes that any deviation from the normal or the recurrence of the slightest and most trivial symptom that was not present before should be carefully considered. Pronounced symptoms will occur very seldom if the dose has been carefully selected. Slight headache, malaise, a feeling of chilliness, are all suggestive and even without the recurrence of the slightest rise of temperature require a repetition of the same dose. Pain in the limbs or joints, faintness, giddiness, sleepiness, fatigue, restlessness, nervousness, stimulation, rarely occur alone, but like indigestion, nausea, and vomiting, are often present at the same time. Insomnia may be due to fever, and the patient should be instructed to take his temperature during the night when suffering from insomnia.

Brown states that in some instances it is difficult to determine whether certain symptoms are due to the tuberculin or not, but whenever there is any doubt it is wise to grade the dose on the supposition that the tuberculin is the cause. He states that formerly the temperature variations were considered the most important evidences of a reaction. It is now known, however, that a reaction may occur without any elevation of the temperature; this is especially true of Denys' tuberculin.

If the temperature becomes elevated after tuberculin, the tuberculin should not be given again until the temperature has been normal for two or three days. A rise of a few tenths of a degree, especially if accompanied by other symptoms, calls for a repetition or a reduction of the last dose. If the temperature reaches 100° F. the dose should be reduced, and if accompanied by marked symptoms the dose should be reduced at least $\frac{1}{4}$ to $\frac{1}{5}$ of that last given. If the temperature exceeds 100° F. the tuberculin had best be omitted for several doses and then resumed at a greatly reduced dose.

Brown states that the pulse gives little information in estimating the dose. If there is a steady and continuous loss of weight it is advisable to omit the tuberculin altogether until the nutrition has improved.

Tuberculin should not be administered in the presence of any intercurrent infection.

In regard to the ultimate dose to be reached, Brown states that each patient must be considered individually. Each patient should be carried up to that dose which begins to produce symptoms of reaction. The dose should then be considerably reduced and slowly increased again. Often the previous limit can be surpassed, but even if this is not possible no attempt should be made to carry the patient on in spite of the occurrence of reaction.

The ordinary hygienic dietetic treatment should be carried on in conjunction with the tuberculin.

Brown¹ gives the following as contra-indications to tuberculin treatment: rapid loss of flesh, malnutrition (so frequent in the late stages), meningitis, acute miliary tuberculosis, non-tuberculous nephritis, epilepsy, pronounced nervousness, and a persistent pulse rate above 100.

Patients best adapted to tuberculin treatment are those who are afebrile and in a state of good nutrition in early closed pulmonary cases. There are not infrequently met with patients who come to a standstill and make no further improvement under the ordinary hygienic and dietetic regime. Tuberculin often acts most favorably in these patients. Tuberculin is also being extensively used at present in the treatment of surgical tuberculosis, and the results so far reported are most encouraging.

DIAGNOSTIC USE OF TUBERCULIN. During the past eighteen months a mass of literature has accumulated on the newer methods of applying tuberculin for diagnostic purposes. These new methods consist in the instillation of a dilute solution of tuberculin into the conjunctiva, the ophthalmic reaction of Wolff-Eisner and Calmette; the cutaneous inoculation of von Pirquet; and the inunction of Moro's tuberculin ointment. The application of these tests has been considered by Ewart in the September number of *PROGRESSIVE MEDICINE*, p. 26. Because of its simplicity, the most popular of these methods has been the ophthalmic reaction. Since Ewart's review has been written, however, a number of serious untoward results have been reported following the use of the ophthalmic test, and this method is now not recommended. Corneal ulcers and obstinate conjunctivitis have occurred after its use.

The subcutaneous method is still the most satisfactory in patients who can afford the necessary time. In using tuberculin for diagnostic purposes the effect desired is the exact reverse to that sought for in the therapeutic use. In the latter a reaction is to be avoided, while in the former it is the object to stir into transient activity a latent or concealed focus.

For diagnostic purposes the old tuberculin (O.T.) is used. The patient is put to bed for thirty-six or forty-eight hours in order to get a record of the temperature. If there is no undue rise to confuse the result, $\frac{1}{10}$ mg. is given. If no reaction follows this dose a second dose of 1 mg. is given after an interval of three days, and in case no reaction follows this dose a third one of 3 or 5 mg. is given three days later. It is essential that an interval of several days should elapse, because of delayed reactions. The test is best given in the evening. The reaction is similar to that described under the therapeutic use of tuberculin (rise in temperature, malaise, pain in joints, headache, and local symptoms).

¹ Osler's *Modern Medicine*, iii, 416.

The use of tuberculin for diagnostic purposes in the manner just described is entirely free from danger. Those having a wide experience in its use have yet to see an undesirable effect.

Urotropin has earned for itself, during the past few years, a very high reputation as a urinary antiseptic, and at present is extensively used for the prevention of postscarlatinal nephritis, and in the treatment of cystitis, particularly of the ammoniacal type. It has also been largely used during the later stages of typhoid fever, in order to render the urine sterile, thus not only preventing secondary vesical disease, but also preventing the spread of the infection to others.

Sollmann¹ has investigated the various formaldehyde antiseptics. He states that urotropin is the urinary antiseptic *par excellence*, vastly surpassing all the other substances he tried.

Crowe,² in some experiments on both animals and man, has shown that urotropin is an excellent agent for sterilizing the bile and other secretions of the body.

In a number of patients with biliary fistulæ, bacteriological studies were made both before and after the administration of urotropin. In every case the microorganisms disappeared from the bile when the dose of the urotropin reached 75 grains or more daily. The patients showed marked improvement, and the bile changed from a dirty, turbid fluid to its normal character. As in the urinary bladder the organisms returned as the dose was decreased.

Urotropin was also repeatedly shown in the cerebrospinal fluid, even after very small doses by the mouth. In one case with a cerebrospinal fistula and a purulent discharge, the organisms quickly disappeared after using the urotropin. The fistula closed and the patient recovered.

Formaldehyde was also demonstrated in the pus from a gonorrheal knee-joint.

In common with many other drugs, urotropin was at first believed to be free from untoward effects, but it is now becoming apparent that it is quite capable of producing annoying symptoms.

Beardsley³ has within a short time met with six cases in which small doses of urotropin produced in five *hematuria*, and in the sixth, an itching scarlatiniform rash, associated with a sense of abdominal discomfort. From a study of the cases reported from the literature, Beardsley has found that hematuria and pain on micturition seem to be the most frequent untoward effects encountered. Others less frequently noted are headache, ringing in the ears, backache, gastrointestinal symptoms, skin rashes, swelling about the eyes, and occasionally albuminuria. That there is in some patients an idiosyncrasy to the drug is apparent from the fact that not infrequently several doses

¹ Journal of the American Medical Association, September 5, 1908.

² Johns Hopkins Hospital Bulletin, March, 1908.

³ Therapeutic Gazette, January, 1908.

of $2\frac{1}{2}$ grains each have produced untoward effects. Others do not show any untoward effect until 40 or 50 grains, in 5-grain doses, have been taken.

The lesson to be learned is that urotropin must be administered with a due regard for untoward effects. The urine should be examined from time to time, as slight irritation may make itself known only through the presence of a few blood corpuscles.

Venesection. The value of this measure in *cardiovascular affections* has been pointed out in a previous issue of PROGRESSIVE MEDICINE, December, 1907, p. 325. Phlebotomy, once performed for almost every known ailment, has become so neglected that its great value under the proper circumstances is at the present time too little appreciated. "Venesection," according to Daland,¹ "is especially indicated in certain cases of valvular diseases of the heart, with well-marked failure of compensation, in which the patient presents extreme dyspnea or orthopnea, cyanosis, tumultuous cardiac action, a rapid, small, feeble pulse, distention of the veins of the head and neck, a feeble apex beat displaced to the left and seen and felt over a larger area than normal; increase in the area of cardiac dulness to the left and right, and not infrequently accentuation of the pulmonic second sound.

"Blood-letting is especially indicated if these symptoms and signs are progressive, despite the administration of the ordinary cardiovascular remedies. Under such conditions, 20 ounces of blood should be slowly abstracted from the median cephalic vein. If degeneration of the myocardium is not extreme, the relief secured is immediate and satisfactory. Cyanosis disappears, dyspnea diminishes, the over-distended veins become less prominent, the heart becomes stronger and less tumultuous, and the radial pulse increases in strength and volume and decreases in rate."

Daland also advises the practice of phlebotomy in cases of pneumonia in which the right heart becomes dilated, and in those cases of uremia associated with high blood pressure.

Veronal. As the use of this drug increases, instances of untoward effects following its administration are becoming more numerous. The occurrence of a papulo-erythematous rash following the administration of small doses of the drug was mentioned in PROGRESSIVE MEDICINE for December, 1907, p. 326.

Ormsby² reports a case in which the untoward symptoms were of a severe and alarming nature. He prescribed for a woman, suffering from neurasthenia, 5-grain doses of veronal to be taken at 4 and 8 P.M. On the fifth day the patient developed high fever, headache, malaise, and a general itching, particularly between the fingers and toes and

¹ Journal of the American Medical Association, August 29, 1908.

² Cleveland Medical Journal, January, 1908.

dorsum of the hands and feet. The veronal was discontinued, but the symptoms grew worse, and three days later she developed delirium and general restlessness. At the same time the upper and lower extremities and the face became red and swollen. The dermatitis gradually spread over the entire body. The face became enormously swollen and the extremities edematous; the condition bearing a marked resemblance to generalized erysipelas. During this period the fever ranged from 104° to 106° F. In the course of a week these symptoms disappeared, but later the nails became black and brittle, and were subsequently replaced.

Woolley¹ records a personal idiosyncrasy manifested by the appearance of a localized erythematous eruption over the first metacarpophalangeal joint of the left hand. It was very itchy, somewhat elevated, and of a brilliant red color. A day or so later it was covered with a number of small vesicles. This untoward effect followed a dose of 5 grains. Subsequent trials with the drug resulted in a similar experience while other hypnotic drugs did not produce this effect.

Steinitz² calls attention to instances of veronal poisoning in which the symptom-complex resembles hysterical unconsciousness. The somnolence varies from an apparently deep sleep to coma; the limbs are relaxed and the tendon reflexes retained. A curious feature is the loss of the corneal reflex with retention of the pupil reflex. Veronal poisoning is differentiated from hysterical unconsciousness by the absence of a history of previous hysterical attacks and the presence of veronal in the urine. Steinitz has collected 13 instances of veronal poisoning from the literature; 4 of these ended fatally after doses of from 165 to 300 grains. The remainder recovered; the amount of veronal taken by the cases ending in recovery ranged from 37½ to 135 grains.

The mild cases recover without any treatment, but in the severe ones every means must be taken to promote the elimination of the drug. The stomach should be washed out; the bowels evacuated by means of castor oil; and diuresis promoted. Saline solution may be administered subcutaneously or by rectum. If the respirations flag, tepid baths and cold douching are advisable.

Nieuhaus³ reports the case of a woman who took 60 grains of veronal with suicidal intent. The picture was that of uremia. Recovery was protracted, extending over a period of two weeks. The presence of veronal was detected in the urine of this patient.

¹ Journal of the American Medical Association, December 23, 1907.

² Therapie der Gegenwart, May, 1908.

³ Correspondenz-Blatt, 1907, xxxvi, No. 12.

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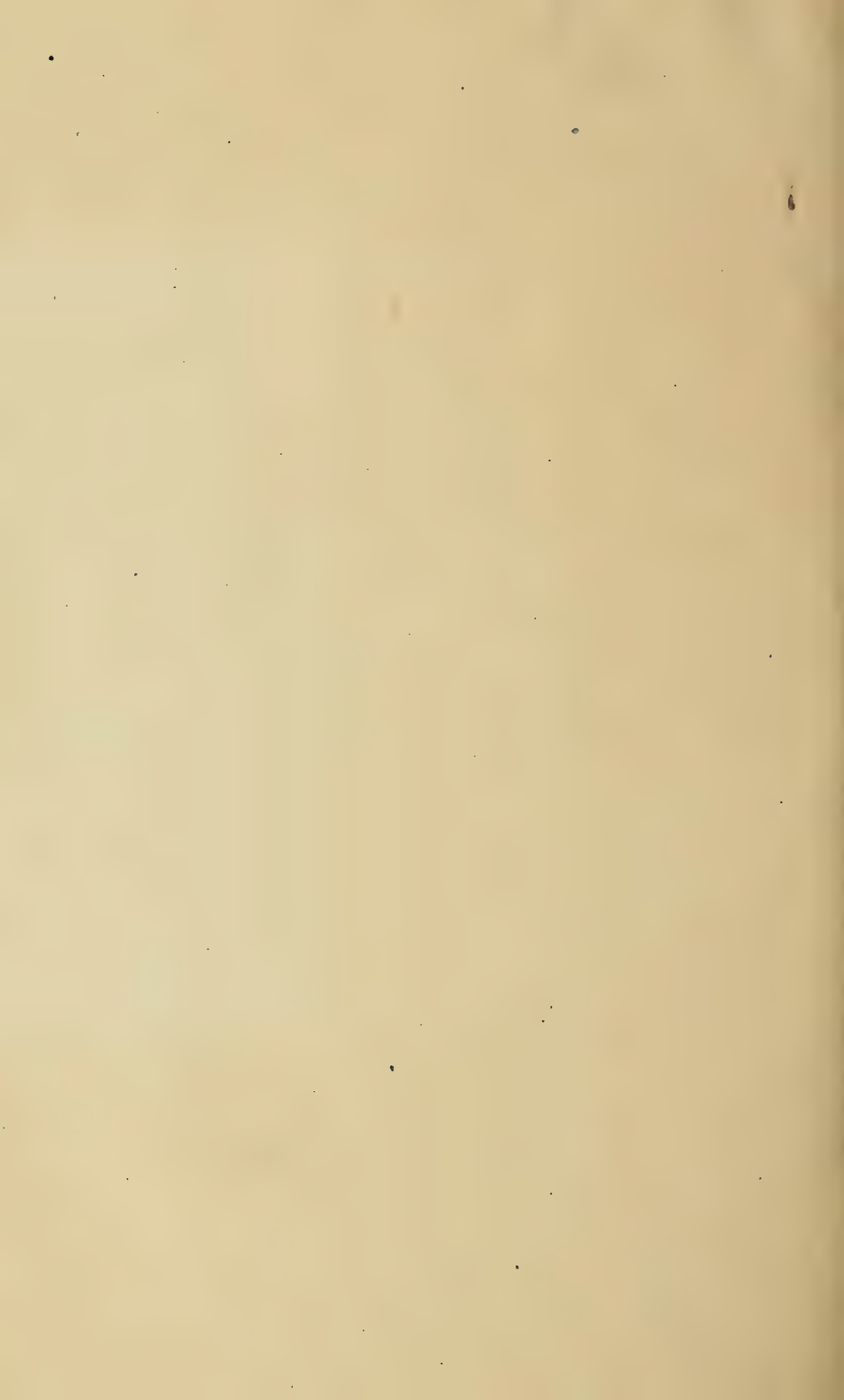
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